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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

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No "Back Numbers"

By the expedient of photographing typewritten pages it is possible, in spite of compositors on "vacation," to carry in this and succeeding issues of "Engineering News-Record," current news and editorial comment. The use of an old date on the cover temporarily means merely that we are carrying out a policy of giving readers the full number of issues to complete and make continuous their half-yearly volumes.

This and following issues are in no sense "back numbers."

Where the Farmers Stand

The National Grange, with a membership of 600,000 farmers, meeting in annual convention in Grand Rapids Nov. 15, refused the invitation of the American Federation of Labor to meet with it in Washington Dec. 13. Other farmers' organizations have taken similar action. The ground for the Grange's decision was that there is nothing in common between the two organizations. The Grange probably would have refused an invitation from the Federation even in the latter's conservative days but the refusal now has special significance. It shows that in any test between radicalism and sanity the farmers can be counted on to be sane.

Will the Federation Learn?

To any one who desires to learn, there is fully convincing evidence that the course latterly pursued by the American Federation of Labor has shorn it of its influence with the public. Such evidence appeared during the Boston policemen's strike, and during the steel and coal strike. Now the farmers, disclaiming any identity of interest, have refused to attend the meeting to be held in Washington Dec. 13, the meeting advertised by the Federation as a conference of organized labor and the farmers. To outsiders the lesson is evident: The public will have nothing to do with radicalism. But will the Federation learn the lesson? Will the conservatives in its ranks, forming the great majority, purge out the radicals? Bent on its present course the Federation can do much harm, but with the country against it it must be the loser in every major test. and eventually must succumb as an institution of influence in industrial matters.

Hearing Grievances

As was to be expected from the evidence, the Senate's committee on the steel strike roundly condemned in its report the radical leadership of the men. Of that we have said enough. The record is not complete, however, unless we set down that the United States Steel Corporation was not absolved from blame. The committee holds that there is a just grievance in the lengthy hours of some of the men, and declares that they had a right to have their grievances heard. On the latter point we want to place emphasis. With the doctrine of presenting grievances the corporation, in theory, was in accord; in some plants the practice probably squared with the theory. In general, though, machinery was lacking for giving grievances prompt and proper attention. In this respect, the corporation, despite its safety and sanitary work and its stock-selling plan, failed to measure up to the standard demanded of present-day industrial organizations. The committee goes further and declares that the men should have been permitted to have representatives of their own choosing; obviously, union representatives are in mind. With this view we have already expressed our disapproval, but that does not blind us to the just criticism regarding the lack of machinery for hearing the grievances of the men.

Crane Runway Difficulties

Repeated experience during the past three or four years made it evident that annoying complexities can turn up unexpectedly even in so straightforward a problem as that of building trestle supports for a traveling bridge crane. At a number of plants working on war contracts, crane runways developed a disconcerting lack of rigidity and had to be reinforced. The direct cause, it is said, was th hard service attendant upon speeding up for increased production. Yet we feel safe in saying that no structure in which sound theory had been strictly taken into account gave trouble even in the stress of those times--though information concerning the difficulties has naturally been kept private. It is a fact

that until relatively recent years empirical practices still held a place in crane-runway design, as they did in various other departments of the structural art. It would be a serious error to undervalue such practices; being crystallized from hard-won experience, they are certain to be for a time far in advance of any conclusions that scientific theory can furnish. But the growth of service conditions is almost certain to render them obsolete in time. Safety lies in frequent cross-checking between practice and theoretical deduction. Hitherto we have had to depend mainly on failures, or cases of incipient failure, for such cross-check. In the present state of the art there is opportunity for applying strain measurement and other methods of precise observation to the purpose. And the field for these methods will grow larger as structures increase in complexity.

Elastic Action and Practical Construction

Some years ago it was still not uncommon to estimate the transverse effects of bridge cranes on their supports by judgment rather than by calculation. As crane requirements became more severe, however, methods were refined, and a modern aspect was given to runway design. Still other phases of the problem are reflected in the remarkably heavy and thoroughly studied Newport News crane runway described in the present issue. This structure was built to meet exceptionally stringent service demands. Great carrying capacity a high degree of rigidity, and the unusual requirement of structural continuity over the full thousand-foot length combined to put a very special problem before the designers. In cases of this kind, difficulties well outside the normal design range confront the engineer, and he must be prepared to apply the full resource of scientific method in dealing with them. Generally speaking, the study of elastic structural action is likely to be found involved as a key point in the problem. The Newport News runway is a clear illustration, and thereby gives evidence of the steadily growing importance of this part of structural theory in practical construction. Except for a few minor expansion joints, the entire mass of steel is an elastic entity, and its design could not be carried through safely unless the distortions and stresses in various directions were kept in view. In particular the rigid-frame analysis made of the transverse bents represents a calculation of a kind that will undoubtedly play a considerable part in future structural engineering.

Nature Confirms Engineers Arguments

Nature sometimes furnishes arguments that are far more convincing to the layman than any well-worked-out plans of engineers, even though the plans are supported with much and sound argument. Last spring, for example the roads of Iowa were rendered almost impassable by a series of rains that never let the road user forget that Iowa was the leading mud-road of the Middle West. Her citizens and high officials had boasted, and with reason, of the dragged earth roads as being superior for most of the year to many surfaced roads. No one, of course, claimed that they were usable 365 days in the year. The engineers knew that a change of view would come, and they graded, dragged and bridged diligently so as to get the best service from what roads they had. The change came when nature sent the rains.

What the rains did in Iowa-- turned public sentiment in favor of the plans advocated by the engineers-- absence of moisture has done in the irrigated districts of Colorado, Wyoming, Utah and Idaho. All of the "dry" farmers in these districts have lost their crops. Storage water in the district east of Denver is at a premium. Only the oldest rights are recognized. For the first time in history of the water-works of Denver, water stored for domestic use (in Cheeseman Lake) has been sold to farmers east of Denver. Storage, and more storage, is in the mind of every farmer. The predictions of the engineers on what would happen without it have come to pass, and no press agent or propagandist could be more effective.

In Utah only those irrigators with rights thirty years old have been recognized since July, and the State Engineer is considering seriously adding on another 10 years. Scanty snowfall in the mountains last winter, and little precipitation since, have brought the flows down to those of record-breaking minimum years. For many years engineers have known that the Jordan and Weber Rivers poured large volumes of storm water into Great Salt Lake. Numerous storage-reservoir sites exist, and the streams are so close together that an interchange system can be worked out within reasonable cost. Eight counties have now been aroused, and more than $10,000 has been raised for an engineering investigation to determine what is feasible. Reclamation of from 100,000 to 200,000 acres, in addition to insuring water from many late filers, is hoped for. The Jordan River filings have never been adjudicated, so the task of gathering data is imperative. Whether Government aid can be obtained or the state or private capital builds the works, nature has brought the residents to the point of taking the first step toward its accomplishment, and the engineers are at work.

In Idaho the American Falls dam project on the Snake River, where a dam higher than any yet built has been a dream of engineers for years, is now clamored for. Only Government aid can assure this, for the cost will be enormous, $13,000,000 or more. However, the losses, that might have been prevented are said to represent a larger total. No wonder that Government officials are followed around by the interested persons wherever they travel in those parts.

The call now is from the man on the farm. The promoter is less in evidence.

Maintenance of Land Drainage Systems

Land drainage is at present confronted with one of the difficulties, lack of appreciation of necessity for maintenance, that seems to beset every engineering act before its processes or structures come under the care of elaborated organizations.

In the development of highway systems we have had the same experience. There was a feeling on the part of the laymen that once built the works would take care of themselves or at least could be cared for

without expert guidance. For that error the public treasury has paid dearly, and today, after a persistent campaign of education by engineers and technical journals, aided by the impassability or roughness of unmaintained roads, road maintenance is established as a necessary function of expert highway administration.

Parallel cases are found in the operation of water purification and sewage disposal plants. Inexperienced attendants, laymen boards contended, were competent to run the plants.

Even today in these three classes of works, ideal conditions do not obtain. The smaller water and sewage plants frequently suffer from inexpert operation, the county and township road systems from inexpert maintenance.

Just so is the condition in drainage work today. Drainage systems are designed by engineers and are built more or less under their supervision, but when completed they are left-- in most cases-- to take care of themselves. Banks slip or fall, silt is deposited, weeds and brush grow, and floating debris accumulates until the channels are choked and flow is restricted. The ditches are designed and built to carry off a certain amount of water in a given time.

If the capacity is reduced, the ground or flood water is not carried off as rapidly as was intended. The water level is kept higher than it should be, and the land may remain wet and unsuitable for cultivation, or crops may be spoiled if not destroyed.

As a rule the remedy adopted consists in local spasmodic attempts at cleaning, but not until after the ditch has fallen into bad condition. Even if the full length of the ditch is cleaned, the results are apt to be unsatisfactory, for the work is done without expert advice. Thus there is likely to be too much or too little excavation, and the designed grade and capacity of the ditch are rarely restored.

To maintain works of this kind in service condition, continual inspection and maintenance under expert supervision are necessary. Some progress in this direction has been made in regard to the operation of pumping plants, but the operation of ditch systems has received little attention. Undoubtedly, there are some well-maintained systems; data regarding the methods of procedure, and observations of the flow and capacity of the ditches over a period of years need to be collected and then disseminated for the general benefit.

Drainage works maintenance will have to be the text for persistent educational propaganda, and in such procedure the citation of works now properly maintained will be of great assistance. For that reason Engineering News-Record solicits correspondence with those who have knowledge of or experience with systems under expert maintenance, to the end that the data may be laid before the profession.

In Next Week's Issue:

The Railway Problem

By Charles Whiting Baker

Consulting Editor, "Engineering News-Record"

Ability vs. Seniority in the Corps of Engineers

No appointment has yet been made to fill the vacancy caused by the retirement on Nov. 1 of Major-Gen. Wm. M. Black as Chief of Engineers, U. S. Army. The Washington correspondence in the news columns of this week's issue, however, indicates a strong trend in favor of Col. (lately Major-Gen.) W. C. Langfitt. A few of the reasons why General Langfitt should be the next Chief of Engineers were set forth by "Engineering News-Record" in its emergency bulletin of Nov. 6, published while the printers' strike delayed our regular issues. They may well bear repetition.

His chief claim to recognition rests upon the soundest of foundations-- demonstrated ability. As chief engineer of the American Expeditionary Forces he survived the severest kind of test. He proved conclusively his ability as an executive and a producer of results. If he had not done so it is certain that his tenure of office as head of the overseas Engineer forces would have been short, for General Pershing did not deal gently with department heads who, for one reason or another, failed to meet the exacting demands made upon them.

While General Langfitt is best known for his work as the chief engineer, A. E. F., it should be noted that one of the stepping stones to this post was the command of the American light railway regiments which served much of the time under fire-- with the British armies. An officer well informed on matters concerning the A.E.F., has said that during this detail with the British Gen. Langfitt was under fire oftener than any other American general officer during a similar period. The incident is cited merely to indicate that General Langfitt's experience has been well-rounded. He has seen much of the fighting front and has had the opportunity of learning not from report or manual, but at first hand, the problems of combatant troops as well as those of officers and men assigned to S.O.S. duties. Both are of vital importance in the machinery of modern warfare.

Initiative, vision, personality, knowledge of men, ability to command respect and at the same time win the support and loyalty of subordinates-- that nameless combination of qualities which every really great executive possesses-- must be a part of the next Chief of Engineers. Army men of the old school are not so apt as are those in industry or commerce to evaluate this quality at its true worth. To many of them, officers with silver eagles on their shoulders are all "colonels," cast in the same mold, one as good as another for any job demanding a "colonel". Business, on the other hand, in choosing its executives, attaches great importance to the human or personal element in its leaders. The army must do likewise. The day of the martinet in high office has passed.

War is business organized on a national scale. Business principles must govern the administration of the army's staff corps such as the Corps of Engineers. If the next Chief of Engineers is to be selected on the straight business basis of his ability to fill the job and not on a basis of seniority, the choice of candidates narrows down to a single man--- William C. Langfitt.

What Will Engineers Pay To Improve Their Status?

Readers of "Engineering News-Record" have entered freely into a discussion of the question, "What Will Engineers Pay to Improve Their Status?" An editorial treatment of that question in the issue of Sept. 11 *brought numerous replies, some of which follow:*

F. LAVIS
American International Corporation, New York City.

Probably because I have been away so much, this editorial was the first intimation I had had that the American Society of Civil Engineers had refused to vote an appropriation to forward the work of Engineering Council, and I doubt very much that the action of the annual meeting in regard to this would have been taken in the negative if the matter had been presented in the way it is in your editorial.

Probably most of the members, used to the inertia of the A. Soc. C. E. in regard to public matters and its assumption that it was undignified to do anything more than collect dues, accumulate a surplus and read extremely technical papers, could not realize the possibility of a change, but even the Am. Soc. C. E. has shown signs of life and a little red blood recently, and I believe that if the matter is presented to the membership now, with an adequate statement of the aims and objects of Engineering Council—and if this statement shows that the council will adequately represent the engineering profession as a whole in public matters—there will be an overwhelming response in favor, and no difficulty in getting the necessary funds.

I believe your efforts to obtain greater publicity for this matter are to be commended, and I hope there will be, if necessary, a direct appeal by the council to the members of the profession, as I believe the large majority will support it, as I am prepared to do myself.

R. B. SHEPHERD, JR.
Valuation Engineer, Atlantic Coast Line Railroad, Wilmington, N. C.

Personally, I feel that the engineering societies should confine their conscious efforts to the advancement of engineering knowledge and good practice and to the establishment and maintenance of a high moral and ethical status for the engineering profession. The improvement in status to which your editorial is addressed should result from the spontaneous and voluntary recognition of the beneficial activities of the engineers and of work well done.

I should be unwilling to encourage any organization which had as its object the forcing of a better material status from an unresponsive and begrudging public, and I believe that this feeling is shared by many of the engineers with whom I come in contact. A great many, if not most, of the representative engineers of standing are unalterably opposed to any steps or organizations which savor of labor unionism. With regret I am forced to class in this latter category certain combinations of engineers which have arisen of late, and I believe it is to the feeling that their activities are too closely related to labor-union methods that the apathy to which you refer is due.

A. L. DABNEY
Consulting Hydraulic Engineer, Memphis, Tenn.

It has come to be the question not "What Will They Pay?" but "What Must Engineers Pay To Improve Their Status?" They must improve it, and general discussions without definite action will not do this. It is to be hoped that general discussion will, however, lead to definite action, which must be had through the instrumentality of a strong organization for the purpose.

The average engineer is too fully engrossed with the problems of his clients to give much thought to his own problems. If he had time to work directly for improving the status of his profession (and with it, as a logical result, his own status), he would not know how to start. He must help to support an organization maintained for the express purpose of doing this for him. He will gladly do so when he understands that the organization is going to "get busy" and bring results. Nearly every other class has bettered its condition by organized effort (for which it has had to pay). Engineers must do the same, or they will become the burden bearers for the rest of mankind.

Your suggestion of a "dramatic presentation" is wise. It is most urgent that the individual engineer be more fully awakened to the necessity for united and whole-hearted action. Having aroused the whole profession from its lethargy in relation to such matters, the next step will be to make such a "dramatic presentation" to the public that the important part of the engineer in the activities of the world will be more fully understood. Instances in great number could be cited, showing a lack of such understanding. The following are fresh in mind:

1. Recently I read a drainage law, enacted as late as 1909 by a nearby legislature. It provides that the court shall allow the engineer not exceeding $5 per day for time actually at work.

2. On a large war construction job where conditions in the mess-halls were not very appetizing, a new and better mess-hall was built, and was stated to be for executive and technical men, and for the women employees. The executive in charge—asserting that he was formerly an engineer (?)—would not issue passes to the engineers, saying they would come in perspiring and dirty. A number of clerks and men in minor positions had passes. There was a wave of indignation among the engineer employees, some proposing to leave the job. We were counseled by our chiefs that we were there to help win the war, and should ignore all such small insults, regarding them merely as petty annoyances. We did; and I think no engineer left because of this or for similar cause.

During the war much was published about the important, if not the predominating, part taken by engineers. Many an engineer, much over draft age, left his own field and entered the military service or went on war work. There was no case within my observation where an engineer tried to avail himself improperly of an advantage due to the urgent need for his services.

The war is over, and we are now at liberty to consider what we owe to ourselves. We must insist upon proper recognition by the Federal Government, by state legislatures and by municipalities in the fixing of engineers' salaries and placing engineers in executive positions. The public must be made to comprehend what we are and what we accomplish. e need an engineers' license law in every state. The status of the profession is much injured because incompetents can take engineering work in most communities. Members of the community get their impression of engineers' standards from the incompetent under their observation.

If Engineering Council has not the authority to go into a "dramatic presentation" by means of letters, magazine and newspaper articles, representation before law-making bodies, etc., its authority should be expanded. If a program for action is then sent out to engineers of every grade, with a request for contributions, for initial expenses, pending definite assessments, I believe a great many will respond liberally. A selected list should be asked for $10 or more; and all others for $2 or more.

Let's do it.

F. H. NEWELL
President, American Association of Engineers.

In your editorial of September 11, page 492, you touch a point of vital importance at the present time to engineers, when you ask "What Will Engineers Pay to Improve Their Status?" This is a question which many of us have been asking in different words. In particular, as the president of the American Association of Engineers, I have devoted a large part of the summer to personal study of this and related questions. I have visited many of the centers of population, from the Atlantic to the Pacific coast, meeting engineers of all kinds—civil, mechanical, electrical, mining, and chemical—socially and in their offices, obtaining a broad

view of the situation.

It is one which it is hardly necessary to say is seething with unrest. In this it partakes of the prevalent attitude of society, following the great war, but in addition there are forces for discontent at work which are peculiar to the engineering fraternities and which can be relieved only by effective action of its members. Surveying engineers as a whole, there may be distinguished three classes:

First and foremost, a vast army of a million or more, the mechanics, commonly and by legal definition (see dictionary of law terms) know as engineers. To these we of the engineering profession deny the use of the term "engineer," but classify these men as engine runners, or artisans. W do not admit them to our engineering societies nor do they dare to join; they have their own organizations, usually labor unions.

Second, the junior engineers, possibly a hundred thousand strong or perhaps a hundred and fifty thousand. These are the noncommissioned officers of this great army. They are the men who are executing or supervising the details of engineering work, making plans, computations, inspecting and performing innumerable details under general directions of higher officials. These men form the rank and file and pay a large part of the dues of the engineering societies, although but a small minority of the hundred thousand are thus included. They are less well paid, as a rule, than are the mechanics, especially that portion of the million men who are in the labor unions. For this reason they are being urged to join the latter.

Third, are the senior engineers, say ten thousand of them, men who are recognized as skilled in their profession, usually employers of engineers or responsible chiefs of engineering organizations. These are the men who practically control the technical or specialized engineering societies and who are trying to obtain a high standard of technical society activities.

Assuming that these figures are relatively, but not absolutely, correct, we can consider your question as to "What Will the Engineers Pay to Improve Their Status." Those engineers who are the privates in the ranks—namely, the mechanics or artisans—will and do pay large sums to maintain their status through labor unions. They can and will pay millions if necessary to carry out their plans.

What will the one hundred thousand junior engineers or the non-commissioned officers pay? Here is the point on which the American Association of Engineers stakes its future. Experience has shown that these men will pay at least $10 a year, and as much more as may be necessary, provide dthey see a direct benefit and have confidence in their leaders. As fast as they see results achieved they willingly contribute to the funds needed for other enterprises.

In other words, the amount of money which can and will be paid by the junior engineers to improve their status will amount to $1,000,000 or more a year; this will be done just as soon as the men are thoroughly convinced of the fact that their funds are being used wisely and efficiently in producing results. Already over 7000 of the hundred thousand are paying, and the number is increasing at the rate of 1000 a month. From all indications, this rate will double just as soon as better facilities are provided for handling the increased correspondence and details of the business. These men and their wives are beginning to see that their status, their ability to buy food and clothes and obtain decent surroundings, are dependent upon wisely conducted organized effort in their behalf.

How about the ten thousand senior engineers? Apparently they are content: their financial and social standing is assured, they have control of technical societies, each doing excellent work in its own way, in its publications and meetings. The $15 or more which they pay annually is needed to maintain their somewhat elaborately furnished New York offices and library. Relatively few are willing to pay more, because they believe that this sum should be adequate; their imagination is not touched by the somewhat remote projects which are proposed. These men consider themselves, and doubtless are, the "best men" of the profession. They form truly the aristocracy, using this term not in derogatory sense but in its original meaning, "the best people." Their chief anxiety is to maintain high professional standards, and to do this they believe that the only way is to keep the control in the hands of men who have distinguished themselves not so much as leaders of me nor sympathizers with the tims of democracy but as high-grade specialists.

At this time in the evolution of organization of engineers it is worse than useless to try to conceal certain facts, even though these may be unpalatable. One of these is that the great body of engine runners or mechanics—the million privates in the army—have little or no regard for the officers, especially the junior engineers upon whom they look down as being unwilling and unable to unite or to take effective action to obtain adequate pay. They are willing that these men should affiliate with them in their labor unions, knowing that they will be an inconsequential minority.

The second striking fact is that the great body of junior engineers or noncommissioned officers is somewhat distrustful of the seniors, from the human or social standpoint, not in a technical way. Deeply buried in their consciousness is the feeling that these leaders have not been loyal to the trust imposed upon them. The latter have had for a decade the means for securing to the younger men better recognition, in pay and in conditions of employment. They have neglected this trust and, while frequently talking about it, have taken few if any direct steps to help matters. Let anyone visit the larger engineering offices—public, corporate or private—contrast the working conditions of light, ventilation and space provided for the draftsmen and subordinate engineers, or visit the construction camps and see the conditions under which these juniors work. More than this, listen to the daily and hourly discussion, and form your own opinions as to what the juniors think of the men who have advanced technically in the profession and who in doing so seem to have lost many of the attributes of sympathy with the struggles of their subordinates.

It is this condition of the junior engineers that the American Association of Engineers is studying. It is utilizing all of the expedients successfully employed by other organizations of business men. It is ascertaining the wishes of its members: they in turn have a direct, personal control of its officers and activities. Their wishes and suggestions are promptly heeded. The expenses are kept at a minimum and are made known to the individual members so that they may know where their money goes. Every proper device is employed to attract and keep the members and all of the funds or forces available are directed to improve the status of the engineer, and, through him, to benefit the public.

It is now becoming apparent that while the older technical or exclusive societies are needed and are performing valuable functions and should be maintained to continue these functions, yet they cannot and do not have the money, experience and attitude to carry on economic or humanitarian work. For efficiency there must be a larger, more inclusive society, taking in *all professional engineers* and devoting its entire funds and energies to the good of its members. Such an organization is the American Association of Engineers. It is bound to grow, because it is in accord with the spirit of the times and is entirely democratic and responsive to the demands of its members. It is answering the question as to what engineers will pay to improve their status.

It may be asked, What will be the relations of the American Association of Engineers to the older technical organizations? The reply is that it supplements or precedes their activities. The time should soon come when membership in one of the older societies should be conditional upon active membership in the American Association of Engineers. In other words, the older societies may properly demand that a nengineer show his interest in his profession and in his fellowmen by first contributing his share to the American Association to improve and maintain the status of the engineer. Having done so he can be a candidate for participation in technical discussion and for membership to one of the older societies.

D. C. HENNY
Consulting Hydraulic Engineer, Portland, Ore.

In my opinion, engineers will pay generously in services for the purpose of improving their status, and in money far in excess of the small amounts mentioned by you, provided they can be made to see that their contributions will effectively assist in the desired direction.

A proposition to maintain a Washington office of Engineering Council must be shown to be sound and wise, and, for the purpose in view, necessary, and the showing must be made in concise, attractive and attention-compelling manner. A vague claim of advantages to the profession will not answer. Specific objects must be shown, their effect upon the profession and society must be made clear, and the need of funds must be explained in connection with the proposed method of their expenditure.

In all of these respects the question, assuming the cause to be worthy, is one of efficient advertising. The success or lack of success which has attended the specific case cited by you is, I believe, a true measure of the efficiency of the previous advertising, because engineers, as I know them, respond as readily to broad demands upon them as do the members of any other profession.

THEODORE F. SEELYE
Gannett, Seelye & Flemming, Harrisburg, Penn.

I venture to say that comparatively few engineers have any idea of the aims and purposes of Engineering Council, primarily through the failure of its promoters to present to the profession the objects of its organization. I believe that no body of professional men is more jealous of its dignity than the engineering profession, and I cannot conceive a deliberate inattention to a matter which has such high possibilities for them.

During the late war the engineers, through their large efforts, added much to their prestige, and it is certainly up to them to back Engineering Council financially or otherwise, to maintain and enhance this prestige.

W. L. BUTCHER
Consulting Engineer, Boston, Mass.

I am impressed with your reference to the promotion work for Engineering Council. There appears to be a lack of knowledge among engineers as to the function of Engineering Council, and I have heard one engineer state that after listening to an exposition of the council by one of the members thereof he (the engineer) still remained somewhat hazy as to the council's function and thought that this was partly due to the possibility that the council's members did not exactly understand their own status.

It is, of course, axiomatic that to "sell" a proposition one must understand perfectly the goods he has to sell and believe implicitly in them.

It seems to me that to "sell" Engineering Council to the members of the engineering profession its exact aims must be more faithfully set forth than has so far been the case.

WENDELL M. BUTTS
San Francisco, Calif.

A change in the status of the engineer must be made. It must be made by leaders who are more than animated slide rules and cost reducers in their everyday life. Men who are magnanimous leaders at society meetings and in professional publications, but carry their words no further, are not what is needed. These we have had before, and they have not succeeded in any measure. Let us have men with the red blood of today in their veins, let them raise a standard that means action and promises some success, and we younger members will contribute heartily.

The method of educating the American public to an appreciation of the value of the engineer to the community is almost hopeless. This method is put forward by theorists who fail to grasp one fact—the American people will no tpay for anything they do not *have to.* Appreciation and gratitude are located quite distant from the pocket-book in the American anatomy. The American business man, guided by his engineer who knows on just how much an engineer can starve through, is anything but generous.

The writer is just enough of the conservative to hope that the time will not come when the engineering profession will be affiliated with the labor union. Not that he sees the labor union as an enemy to society. The labor union is one of the greatest forces for true democracy in the country. It fights the fight o fthe many against the few; it is misled at times, but not more so than its enemies.

Unless the more conservative elements in the profession do something, however, the younger man, just entering the field, will join such unions en masse. The union offers the quickest remedy for inadequate income—and, say what you will, ethics do not pay grocery and doctor bills.

Let us think up a movement that can force the men who have the say to increase our compensation to somewhere near where it ought to be, and yet let us temper the movement with some of the ethics our seniors have written for us. Come now, let us hear what you have to say. Let us agree on something, and we will back it with more than one dollar, more than three dollars, and more than five dollars a year.

J. C. STEVENS
Consulting Engineer, Portland, Oregon

ENGINEERING NEWS-RECORD has, in my opinion, stated the problem correctly, that engineers will pay for civic and welfare work if the matter is properly and persistently presented to them. I doubt if 60 per cent. of the engineers in the country really know what Engineering Council is and what its intentions are. The question of a dollar a year or five or ten dollars a year is not material.

If a campaign is undertaken to enlighten the engineers of the country on the organization, activities and needs of Engineering Council, I am quite sure there will be no lack of funds to carry forward its work.

Steam and Electric Draglines Compared

A direct comparison of the relative merits of steam and electricity as motive power for large dragline excavators has been obtained in the Englewood dam excavation work of the Miami Conservancy District, at Englewood, Ohio. H. S. McCurdy, engineer in charge for the district at Englewood, gave the results in a paper presented to the New England Water Works Association, Sept. 30, 1919. Material for the Englewood dam is excavated from a borrowpit upstream of the dam, by two 115-ton dragline excavators equipped with 85-ft. boom and 4½-yd. bucket. One of the two machines is electric- and the other steam-operated. They work on the same track, one about 1000 ft. in advance of the other, and their operating results therefore are directly comparable. With electricity at slightly less than 1.6c. per kilowatt-hour, the steam dragline is somewhat more expensive. It is more rapid in operation, but the cost of coaling runs the unit cost of excavation above that of the electric dragline. Each of the machines can comfortably move 150 to 180 cu.yd. per hour, working on a 15-ft. face and loading into standard gage 12-yd. air dump cars.

A general discussion of the use of electric power on the Miami work was given in *Engineering News-Record* of Aug. 28, 1919, p. 417. In that article the statement was made (p. 420) that "with all costs on both sides fully presented, electric power is not much, if at all, less expensive than steam power might be." The statement of Mr. McCurdy furnishes a specific demonstration in support of this statement.

Heavy Double Trestle for Shipbuilding Cranes Over Newport News Battle-Cruiser Berths

Long Runway Without Expansion Joints—75-Ton and 15-Ton Cranes on Same Rails—Truss Loads Divided Between Tower Columns—Transverse Framing Statically Indeterminate

By R. W. Burpee
Engineer, McClintic-Marshall Construction Company, Pittsburgh, Penn.

In the construction of a recently completed double crane trestle over two new shipbuilding berths at the yard of the Newport News Shipbuilding & Drydock Co., Newport News, Va., it was necessary to resort to a design of highly individual character, partly because of the great size and loading of the structure, and partly because of the requirement that no expansion joints should be used in the length of nearly 1000 ft. The problem of dealing with longitudinal stresses in the structure was obviously made difficult by this requirement. In addition, the design was controlled by the necessity of providing heavy cranes for the maximum lifts and lighter cranes for ordinary service, and the use of different spans for the light and heavy cranes. Economy in metal was an important matter on account of the tonnage of steel involved, and it therefore received careful study.

The 1916 naval building program provided for battle cruisers 870 ft. long. The Newport News Shipbuilding & Dry Dock Co. obtained a contract for two of these ships and immediately started preparations for building them. Shipbuilding cranes and trestles much larger than any previously constructed in this country were necessary for this service, and under the special conditions already mentioned the structure described in the present article resulted.

Study of the general plan and elevations (Fig. 2) will show that the trestle covers two shipways, each with a clear working space about 130 ft. wide by 118 ft. high; its length is slightly over 1000 ft. Each shipway is equipped with one 75-ton crane spanning the full width (132 ft. 8½ in. c. to c. of rails), and four 15-ton cranes of a length equal to half the span, arranged two in each of the two runways formed (in conjunction with the outer crane rails) by a double line of crane girders supported over the middle of the berth.

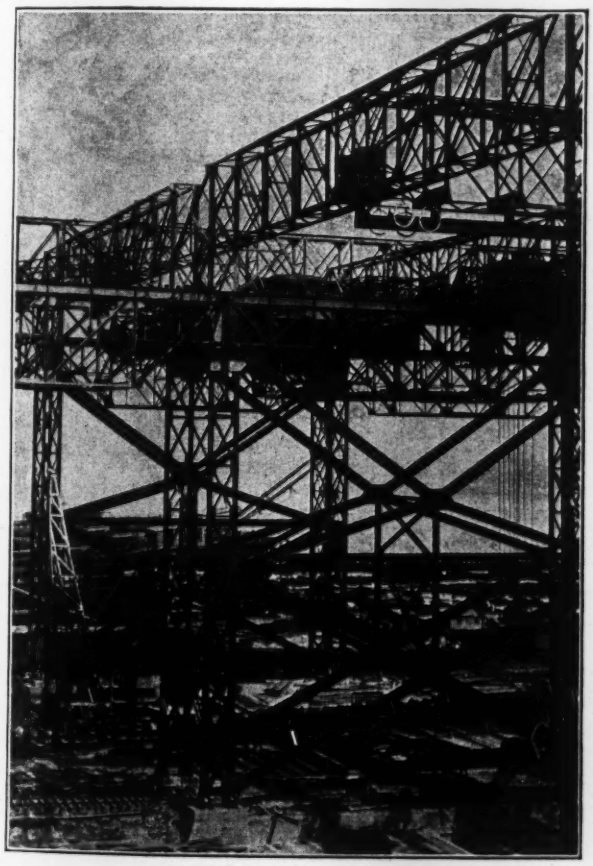


FIG. 1. BRACED BAY OF NEWPORT NEWS DOUBLE SHIPBUILDING CRANE TRESTLE

In this connection, it should be observed that the outer ends of the 15-ton cranes use the same rails as the 75-ton crane, and that the latter is located on the outshore side of the small cranes. This arrangement prevents the small cranes from passing the large crane, which has to be used only at infrequent intervals during the erection of the ship, and then mainly at the stern end. The economy of this arrangement is evident, as it will be seen that provision for the cranes to pass would require two additional lines of trusses the full length of each trestle, and would thus involve a large increase in the cost of the structure.

An interesting arrangement of cranes provides for the supply of material to the berth. As Fig. 2 shows, the main body of the runway is composed of eight bays, each 113 ft. 5¼ in. long, but at the landward end there is a 75-ft. bay supplemented by a 40-ft. cantilever. Through the 75-ft. bay extends a transverse crane runway of 62-ft. span, which brings material from the various shops extending backward from it, and places it under the shipbuilding trestle. Cranes running out of each of the shops bring material to points directly alongside the transverse runway, where it is picked up by an extension arm on the crane which travels on this runway; when the crane moves forward, the arm is drawn in to clear the runway posts. Ordinarily, the material placed under the shipbuilding trestle by the transverse crane is picked up by the 15-ton shipbuilding cranes, but, in order to make it possible for the 75-ton crane to operate here also, the 40-ft. cantilever extension of the trestle was provided; when the four 15-ton cranes are run out on this cantilever extension the 75-ton crane can command the bay over the transverse runway and pick up and handle heavy material to the ship.

In the preliminary design of the trestles, further consideration was given to the limited use of the 75-ton crane. It was then proposed to add a cantilever at the west end on which a transfer bridge would be provided capable of transferring the crane from one aisle to the other. The cost of the transfer bridge was, however, found to exceed the cost of the second 75-ton crane, which fact resulted in the elimination of the transfer scheme.

Expansion Joints Barred by Specifications

It was required by the specifications that in order to assure smooth running of the cranes there should be no expansion joints in the trestle, and this became a governing feature of the design. Longitudinal bracing, therefore, had to be limited to one braced bay at mid-length of the structure, leaving the trestle free to expand longitudinally either way from the middle. Since this expansion would be of large amount, the towers had to be made relatively flexible if excessive temperature stresses were to be avoided. To obtain flexibility, the transverse bents of the towers were spaced 6½ ft. on centers longitudinally.

Absence of expansion joints would at first appear to add materially to the weight of the structure, due to additional stress set up, but careful consideration of the effect of temperature tends to show that the additional metal required is approximately the same as would be consumed in addi-

tional bracing and expansion details. The expansion joints would have been extremely heavy and difficult of design, especially at the intersection of the intermediate longitudinal trusses (I, Fig. 2) with the main transverse trusses (G).

The horizontal movement of the tower tops due to temperature expansion increases from zero at the braced bay to a minimum of plus or minus 2 in., these amounts being computed for a variation of 60 deg. either way, or from zero to 120 deg. F. In calculating the resulting stresses, two different conditions were assumed as giving upper and lower limits: (1) Towers fixed at base and free at top, and (2) towers fixed at both top and bottom. The actual stresses are undoubtedly somewhere between these limits, being more nearly represented by the second case. However, the maximum values found were used. In the extreme towers they produced column stresses as high as —219,000 pounds.

The longitudinal wind and temperature stresses were carried through the truss system by the members shown in heavy outline in Fig. 3. The stresses in the members "a" and the shears *s* between trusses and towers are given in the table below, from which it will be noted that a force of 21,000 lb. is developed by the resistance to a 2-in. deflection of the end towers of the central line. At the other towers the force *s* is less, due to the reduced movement. The individual tower shears accumulate in the members "a," giving a maximum stress of 53,000 lb. in the middle span.

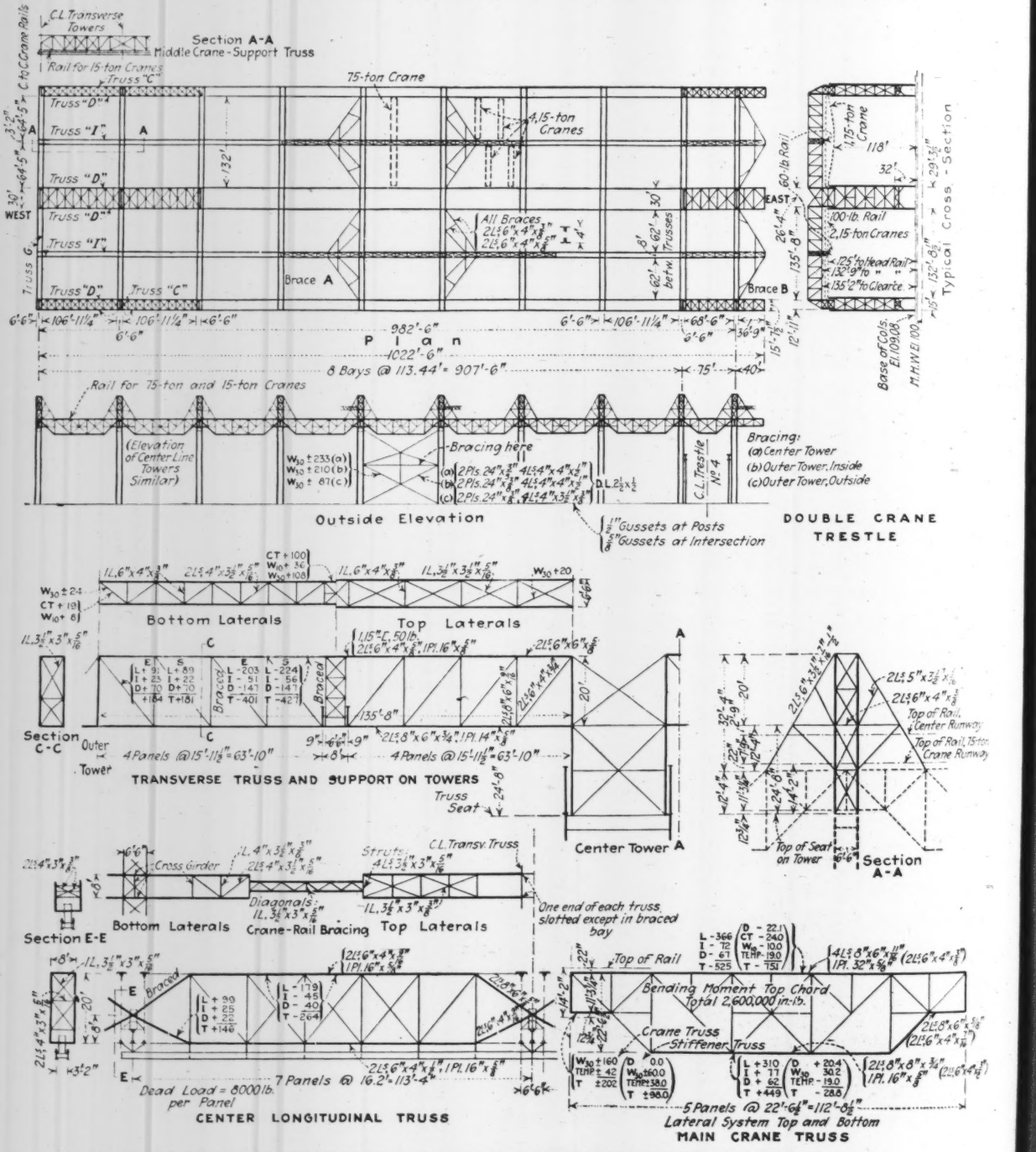


FIG. 2. GENERAL DESIGN OF TRESTLE OVER NEW BATTLESHIP BERTHS AT NEWPORT NEWS

STRESSES IN MEMBERS "a" DUE TO LONGITUDINAL WIND AND TEMPERATURE

(All stresses plus or minus)

Span	Center tower			Outer Tower Inside			Outer Tower Outside		
	W30	Temp.	Total	W30	Temp.	Total	W30	Temp.	Total
End	40	21	61	36	20	56	15	18	33
2nd	80	37	117	72	35	107	30	32	62
3rd	120	48	168	108	45	153	45	42	87
4th	160	53	213	144	50	194	60	47	107
5th	200	53	253	180	50	230	75	47	122

STRESSES (s) TRANSFERRED FROM TOWERS TO TRUSSES DUE TO WIND AND TEMPERATURE

Span	Center tower			Outer Tower Inside			Outer Tower Outside		
	W30	Temp.	Total	W30	Temp.	Total	W30	Temp.	Total
End	40	21	61	36	20	56	15	18	33
2nd	40	16	56	36	15	51	15	14	29
3rd	40	11	51	36	10	46	15	10	25
4th	40	5	45	36	5	41	15	5	20
5th	360	0	360	324	0	324	135	0	135

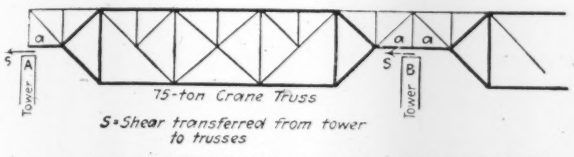


FIG. 3. PATH OF WIND AND TEMPERATURE STRESSES THROUGH MAIN TRUSSES

Considering the wind forces, we find from the same table that the force which transfers from trusses to towers at the braced bay is large, consisting of 200,000 lb. coming through the member *"a"* in compression from the windward end of the runway and 160,000 lb. coming in tension from the leeward end, thus giving 360,000 lb. shear between the towers and the trusses. The necessity of giving proper attention to accumulating wind forces on large structures is here clearly shown. It is again shown in the case of the transverse portals in the lower story of the towers, which provide for material-track and locomotive-crane operation. These portals carry larger horizontal wind forces than most bridge portals, and the column sections were more than doubled in area to carry the resulting bending stresses (see cover-plate arrangement in Fig. 6).

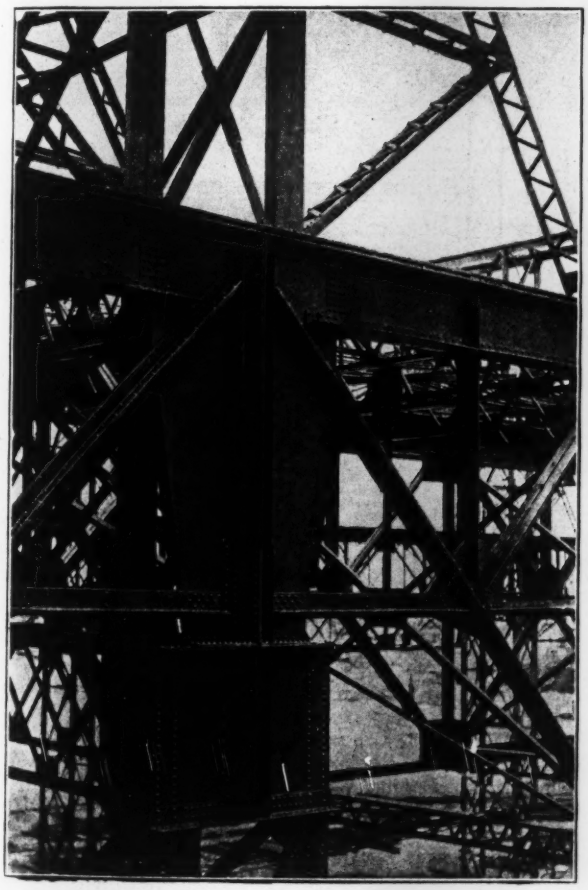


FIG. 4. EQUALIZER GIRDER AND SEAT OF MAIN TRUSSES

Design for Crane Loading

It was required by the specifications governing the loading that the main trusses should be designed to carry the 75-ton crane only. While it is true that the 15-ton cranes might also be on the same span, the probability of both being loaded to capacity at the same time is very small. The increased stresses due to this possible condition are found to be less than 30 per cent. in all cases; overstraining steel to this extent on rare occasions is allowable, and the material saved justifies the condition of loading specified. If such combined loads, however, created excessive stresses and necessitated strict field observance of the specified load conditions, we do not believe that any designer would be justified in placing such responsibility on the field forces.

The 75-ton crane has four wheels per rail, carrying 79,000 lb. each, spaced 6 ft., 15 ft., 6 ft. Two 15-ton cranes close together also have four wheels per rail, carrying 38,000 lb. each, at 15 ft., 3 ft., 15 ft. These are actual wheel loads; they were increased 25 per cent. for impact, in designing. The crane thrust (in transverse direction) was taken at 10 per cent. of the lifted load, and the traction (longitudinal to the trestle) at 25 per cent. of the total wheel loads. Unit stresses ranging from 16,000 to 20,000 lb. per square inch were allowed for various combinations of stresses. Wind pressure was taken into account at 10 lb. per square foot for the loaded structure and 30 lb. per square foot for the unloaded structure.

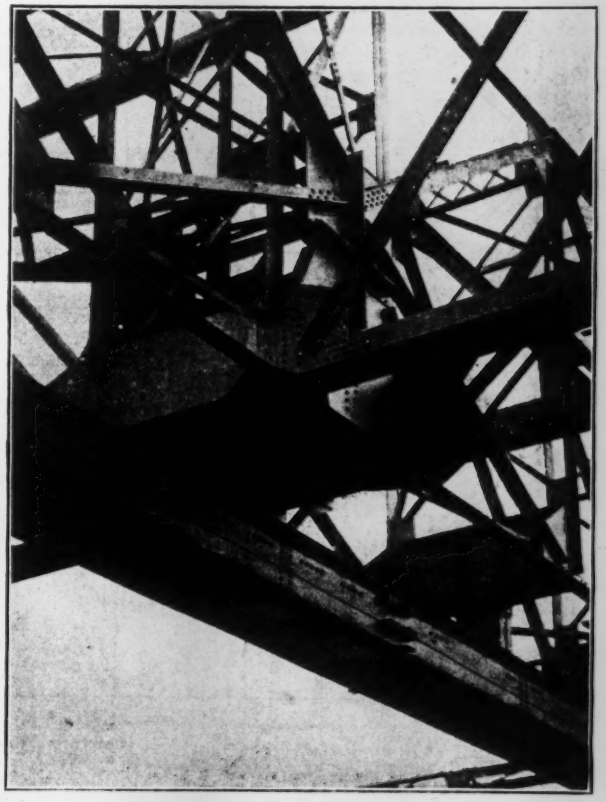
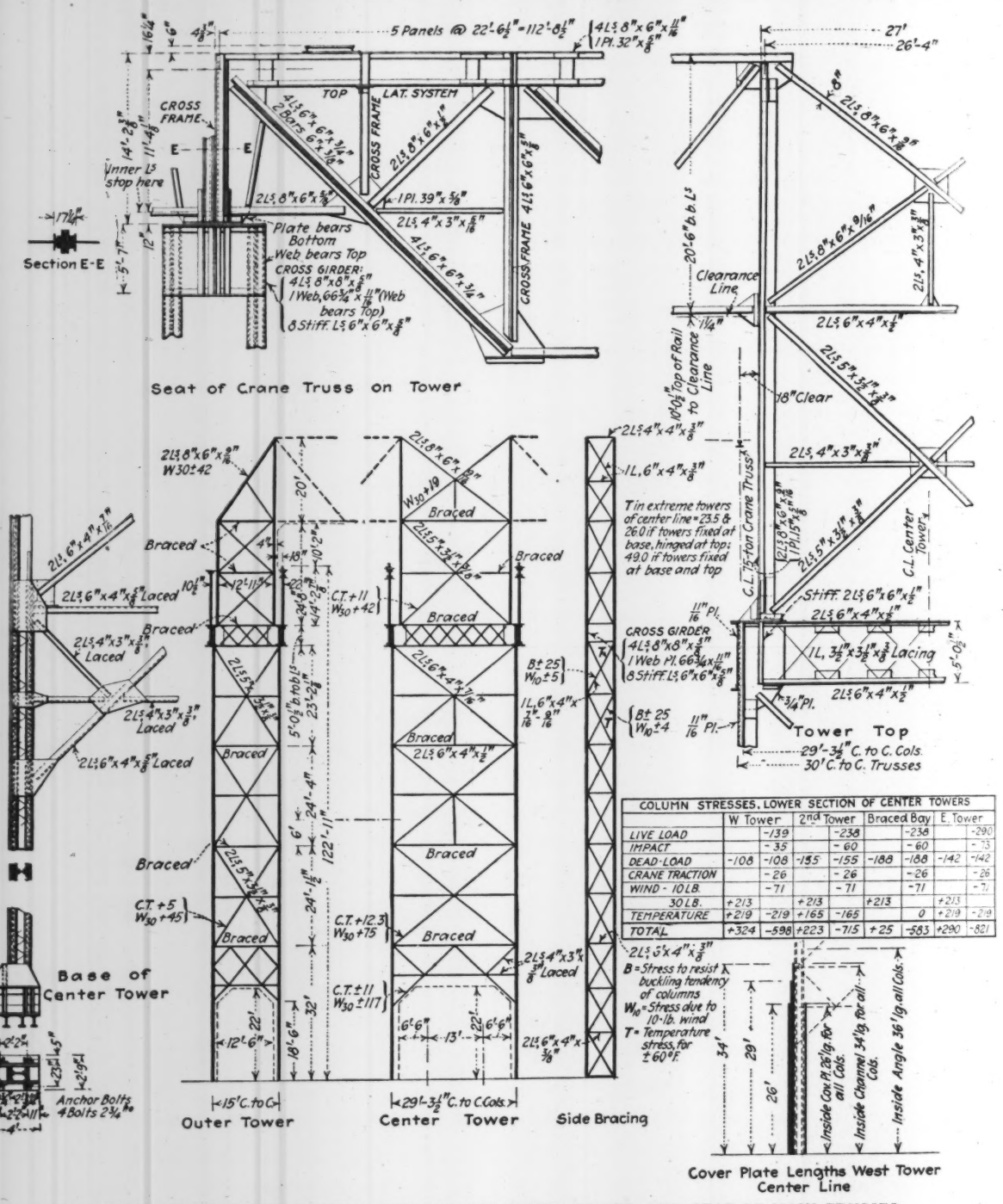


FIG. 5. INTERSECTION OF TRANSVERSE AND INTERMEDIATE LONGITUDINAL TRUSSES



COLUMN STRESSES, LOWER SECTION OF CENTER TOWERS							
	W Tower		2nd Tower		Braced Bay	E. Tower	
LIVE LOAD		-139		-238		-238	-290
IMPACT		- 35		- 60		- 60	- 73
DEAD LOAD	-108	-108	-155	-155	-188	-188	-142 -142
CRANE TRACTION		- 26		- 26		- 26	- 26
WIND - 10 LB.		- 71		- 71		- 71	- 71
30 LB.	+213		+213		+213		+213
TEMPERATURE	+219	-219	+165	-165		0	+219 -219
TOTAL	+324	-598	+223	-715	+25	-583	+290 -821

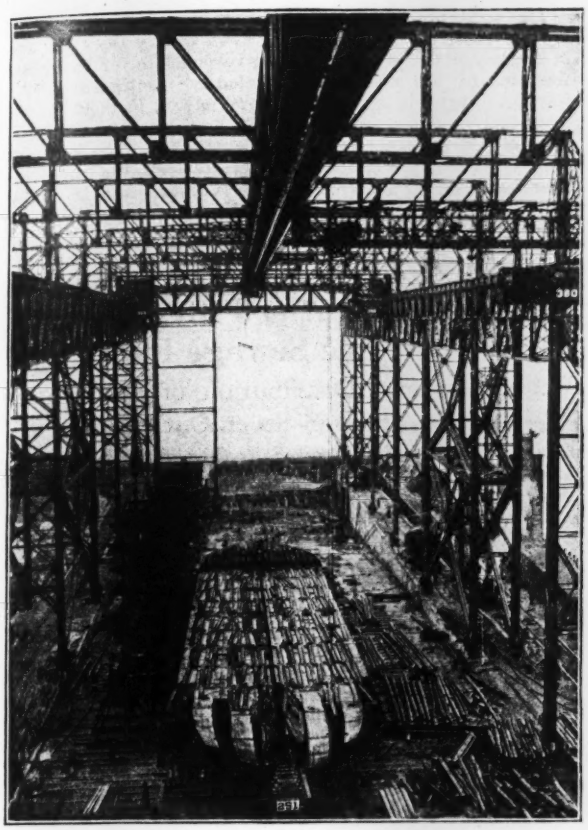
FIGS. 6 AND 7. FRAMING AND TYPICAL DETAILS OF CENTER TOWER AND SEAT OF MAIN TRUSSES

Division of Truss Loads Between Tower Posts

The towers are of four-post construction, and as previously mentioned the bents are set 6½ ft. c. to c. longitudinally. In the transverse direction the towers of the central line are 29 ft. 3½ in. wide and the outer towers are 15 ft. wide. These towers are about 109 ft. high. On each side of the tower, parallel to the axis of the trestle, a cross-girder 66 in. deep is framed between the posts; the main longitudinal trusses are carried by a pedestal on the center of this girder. This arrangement divides all the truss loads between the two tower posts. Since a direct connection of trusse sand posts would have concentrated the maximum truss reaction on a single post, a considerable amount of metal was saved.

Transversely the two posts of each bent are connected by a lattice girder 60 in. deep, on which the narrower top section of the tower is supported. The top section carries that part of the structure which forms the support for the 15-ton cranes ove rthe middle of the aisle. To clear the main crane-girder rails, the posts of this part of the tower are set back 18 in.; their tops are stiffened by an A-frame (see side elevation in Fig. 2- to the cross-frames of the main trusses.

The main crane-girder trusses (D) are 22 ft. 6½ in.



deep c. to c. of chords and are of the single-web type. The top chord, made up of four angles 8 x 6 x 11/16 in. and one web 32 x 5/8 in., carries the crane rail direct. This member is designed for a direct compression of 525,000 lb. and a maximum bending of 2,600,000 in.-lb. The center line of the top chord is about 12 ft. above the cross-girder of the towers, thus requiring an end post and bringing the seat on the cross-girder at approximately the neutral axis of the trusses; the bottom of the end post is connected by a horizontal member to the subpanel point on the end diagonal (Fig. 4). The seat being at the neutral axis, no change in length between towers occurs due to live loads. These end posts are built up of four angles 8 x 6 x 9/16 in. with the gusset-plate continuous between seat and top chord. The out-to-out length of the spans is 3/4 in. shorter than the bay length; the opening of 3/4 in. thus formed between spans is filled at the seat only, and the spans are riveted together through the filler only, so that the continuity of the spans is broken except for the rails. The continuous gussets practically make the top of the tower fixed, as previously mentioned. The detail was used with this point in view, in order to remove as far as possible the deformations due to live load which would result in the upper towers and main trusses if the top of the towers were free.

As the top chord of the crane truss constitutes the crane girder, and its upper flange angles therefore support the crane rail, the web of the chord was carried up to full depth and then chipped, to give a metal-to-metal seat of the rail and relieve the flange rivets from load shear. Furthermore, in order to hold the chord rigidly against twisting, cross-frames with deep latticed struts as upper members were used. The two parallel lines of main trusses on the center towers are joined by a cross-frame at each panel-point and by full top and bottom lateral systems. The single main truss of the outer line is similarly braced to a stiffening truss of the same outline as the main truss.

The supporting system for the two lines of crane rail over the middle of each shipway consists of the transverse trusses G, which with the towers form an indeterminate

FIG. 8 —ABOVE— ONE AISLE OF DOUBLE CRANE TRESTLE

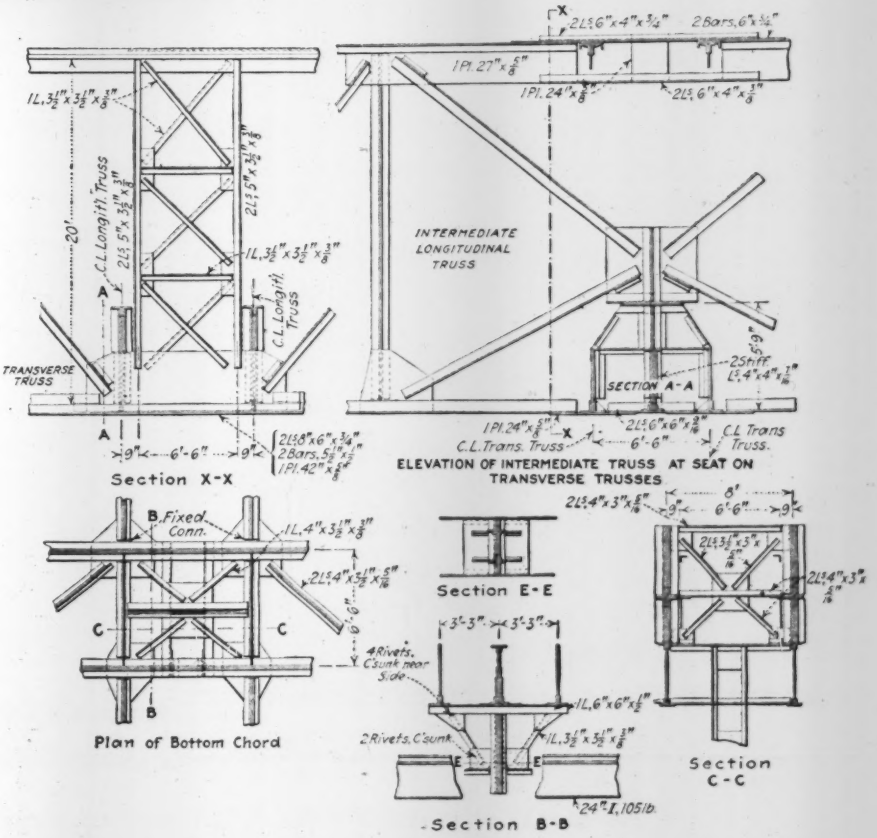


FIG. 9—BELOW—SEAT OF INTERMEDIATE LONGITUDINAL TRUSSES

frame (see cross-section of trestle in Fig. 2). At the center of these trusses are supported the center longitudinal trusses I, under which are carried the 24-in. I-beam runways for the inner ends of the 15-ton cranes. These I-beam runways are 3 ft. 2 in. apart c. to c. and are jointly supported by hangers from cross-girders between the trusses I. The trusses, spaced 8 ft. apart, are divided into panels 16.2 ft. long; there is a cross-girder and runway hanger at each panel joint.

Top and bottom chords of trusses I are parallel except in the end panels, where they converge to a point just below their neutral axis, connecting to a shoe seated on a cross-girder between the transverse trusses G. The vertical forces from these trusses are thus divided equally between the transverse trusses.* The intersection of the two truss systems (Fig. 9) involves many combinations of vertical and horizontal forces and forms a very interesting problem in detailing.

The longitudinal forces developed in the center support system, which is continuous through the I-beam runways from end to end, are transferred to the braced towers by means of the bracing frames A, Fig. 2; the transverse forces on the cantilever at the east end are transmitted to the towers by similar braces.

The most important problem of this design, from an engineering and theoretical standpoint, is the solution of the continuous frame formed by the transverse trusses and towers. This solution for the effect of live load involves the use of the theory of least work with six unknown forces. A complete solution of this problem will be given in a subsequent article, as several points of special interest to future work were noted in the course of this computation.

*Mr. Wolfel advises that this construction is a modification of a similar arrangement used on a Government runway built by the American Bridge Company.—R. W. B.

The trestle is now completed and in operation. The following officials of the Newport News & Dry Dock Co. were in charge of the work and were responsible for the special features of the design as previously mentioned: H. L. Ferguson, president and general manager; F. P. Palen, vice president, and Godfrey L. Smith, civil engineer; the general layout was prepared by Mr. Smith. The steelwork was designed, fabricated and erected by the McClintic-Marshall Co., P. L. Wolfel, chief engineer, and D. S. Gendell, Jr., manager of erection. The writer was in immediate charge of the design.

Multiple Outlet Provides for Variable Sewage Flow

Regulation and Distribution of Sewage Discharge Through Seven Outlets Into Calumet-Sag Canal

By S. T. Smetters

Assistant Bridge Engineer, Sanitary District of Chicago.

A MULTIPLE outlet of 1000 sec.-ft. capacity will deliver the flow of sewage and storm water from 14,600 acres to the new Calumet-Sag channel of the Sanitary District of Chicago. The sewage will enter a five-compartment discharge chamber having seven outlets up through the bottom of the channel. Dry-weather flow will be handled by the center compartment, which has three outlets. As storm water increases the normal dry-weather flow, the side compartments, each having one outlet, will come into operation

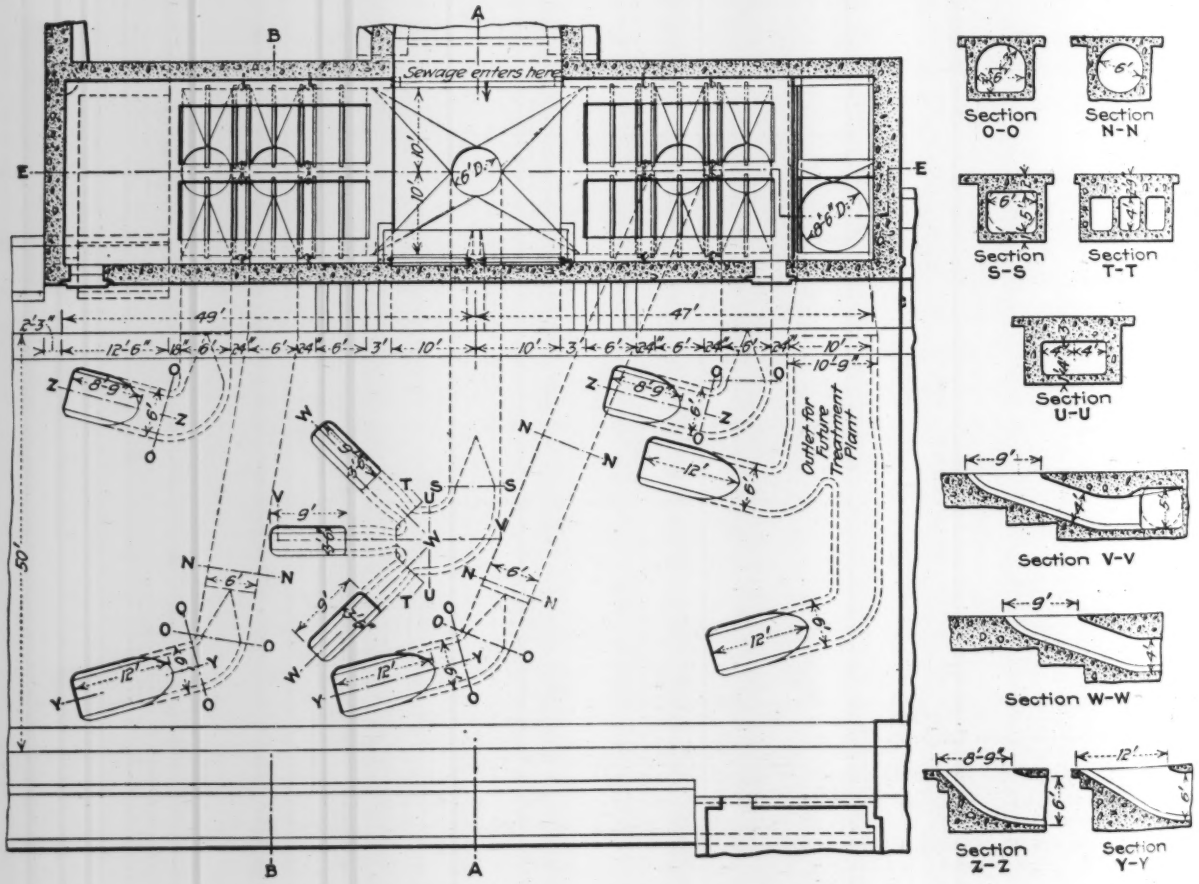


FIG. 1. PLAN OF MULTIPLE SEWER OUTLET INTO CALUMET-SAG CANAL

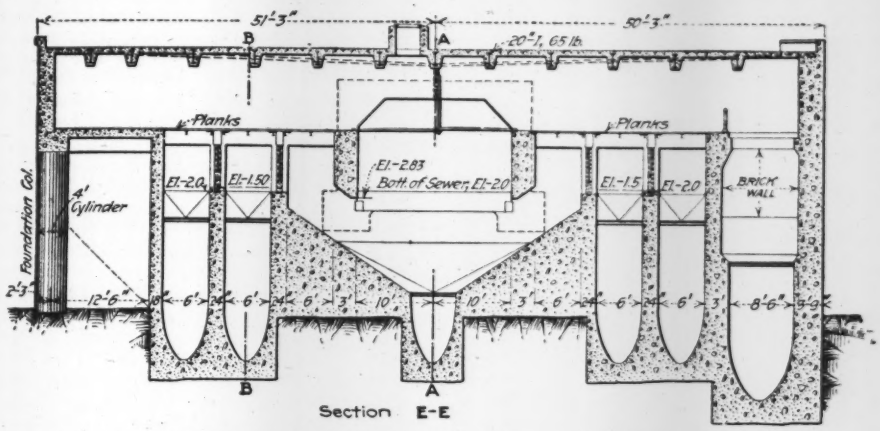


FIG. 2. LONGITUDINAL SECTION THROUGH OUTLET DISCHARGE CHAMBER

in pairs until all seven outlets are discharging to capacity.

The principal service features secured by the arrangement are: (1) a discharge capacity proportional to the volume of sewage being delivered without objectionable loss of velocity when the volume is minimum; (2) a division of the outlet into five units which can be closed off in several combinations to permit examination or to control the direction and the intensity of the flow; (3) the delivery of the discharge in the direction of the canal current and its distribution over a considerable area of the canal prism; (4) the provision of a safety overflow to prevent a clogged screen from backing up the water in the sewer; (5) the elimination of landing places for sediment.

From the Calumet River, about 1½ miles east of Blue Island, the Calumet-Sag channel extends west to a junction with the main drainage channel at Sag. Receiving sewage at its east end and taking flushing water from the Calumet River, the new channel flows west. The sewer outlet is located near the east end, where the channel consists of concrete walls 50 ft. apart on a rock bottom. The outlet occupies an area, under the channel and on the north side, of about 100 x 85 ft. The maximum estimated flow of the 14,600 acres drained is 1000 sec.-ft. Ultimately, at the same place, sewage from a treatment plant will be discharged by a separate, twin-outlet receiving chamber or compartment.

The sewage is received in a rectangular discharge chamber having five compartments, two on each side of a central compartment which is directly in front of the sewer entrance. From the hopper bottom of each compartment a

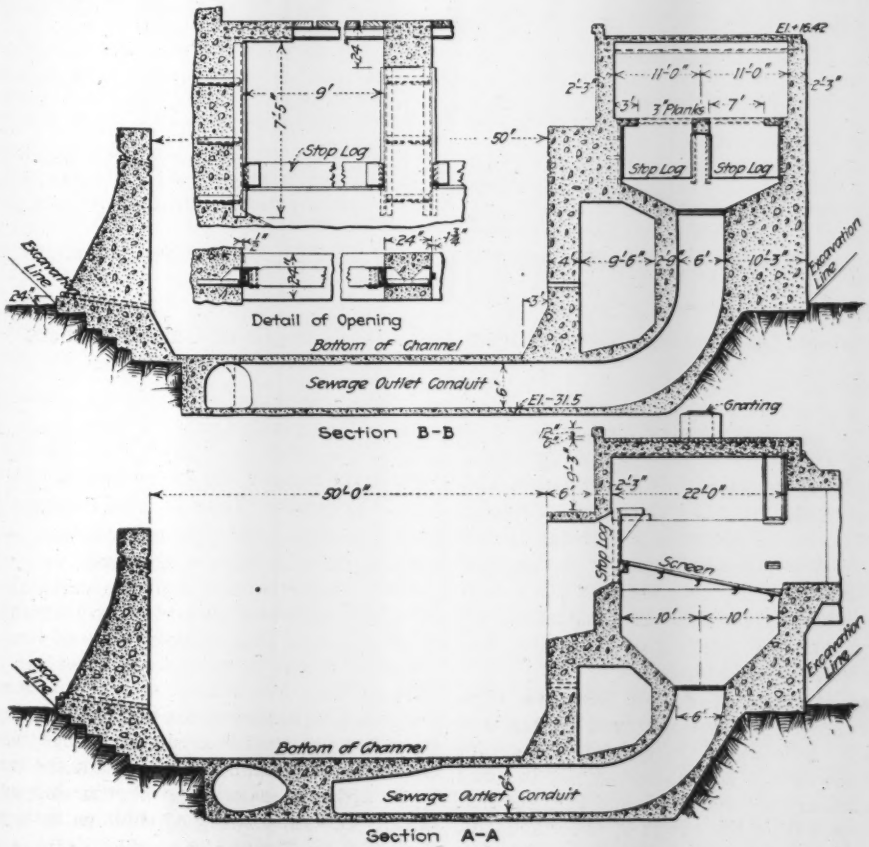


FIG. 3. SECTIONS THROUGH TYPICAL HOPPERS AND DISCHARGE TUBES

6-ft. tube leads down and out under the canal bottom, and at the end curves upward to one or more horizontal openings in the canal bottom. The arrangement of these outlets, as indicated by the plan, Fig. 1, is such that the discharge of the sewage into the channel will be distributed over a wide area and will be in the direction of the current. The area of each tube is 28.3 sq.ft. and the combined areas

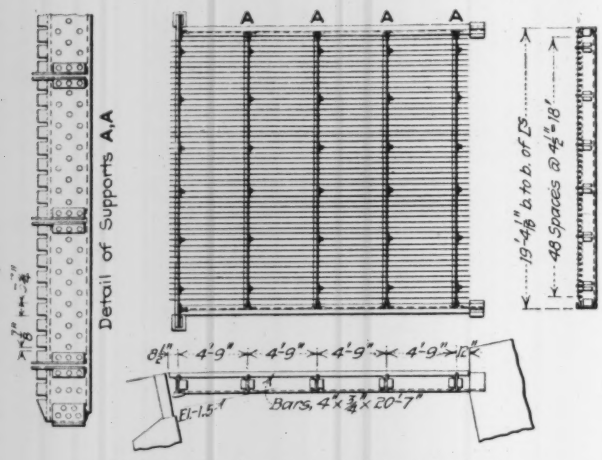


FIG. 4 DETAILS OF SEWAGE SCREEN

of all five tubes gives, at a velocity of about 7 ft. per second, a discharge capacity of 1000 sec.-ft. A head of 1 ft. gives about 7 ft. per second velocity.

The central compartment hopper is the largest and is at the lowest elevation. This hopper receives the dry-weather flow, and, always, all the heavier solids contained in the sewage. Its discharge tube has three outlets, whose combined area is virtually equal to the area of the tube, so that the velocity of flow will be uniform and settlement of solids will not be encouraged. For the same reason the outlet openings are spooned out, as shown by the sections, so that the current will keep them clean.

When storm water increases the volume of sewage beyond the capacity of the central discharge tube, the surplus passes under the baffle girders shown by Fig. 2 and enters the nearest right and left side compartments. When these two discharge tubes have reached their capacity the surplus passes to the extreme right and left end compartments. Flow into the side compartments is regulated by the difference in the heights of the concrete weir walls, and is further controlled as may be desired by closing the entrance openings partly or completely by stop lugs. Only in case of storm-water flow will the side compartments come into operation.

The sewer discharges into the central compartment, over which is a 20 x 20-ft. screen, with side girders in line with the side walls of the sewer, as shown by section AA, Fig. 3. This screen is inclined about 4 ft. in 20 ft., with its low edge at El. —1 and its high edge at El. +1. It was considered that two reasons favored the inclined screen. (1) It could be more easily cleaned and (2) if clogging occurred there would be less backing up of the water in the sewer than would be the condition if a vertical screen were used. In case of complete stoppage of the screen the water can overflow the top and enter the channel through the wall opening shown by Section AA, Fig. 3. The screen construction is shown by Fig. 4, and is distinctive in the respect that each screen bar is separate and removable.

Structurally the outlet includes only one unusual detail, all parts being concrete, with walls, partitions, girders and other slender parts reinforced as the conditions required. The hopper bottoms are unusual in the respect that they combine pyramidal and conical elements in a manner most clearly shown by the central hopper. With this combination there are no landing surfaces to encourage deposits of solids at the mouths of the circular inlets. Form construction was but very slightly complicated by the arrangement, as one pattern served for the four cone elements of the central hopper and another served for all the cone elements of the four side hoppers. Similarly, the conduit parts, as shown by Fig. 1, were duplicates and permitted the use of knockdown forms.

By means of the stop-lug dams any one of the side compartments can be closed against flow and examined by a diver. To close off the central discharge tube for examination a portion of the screen is removed and a steel cofferdam is placed. This cofferdam consists of a 3-ft. tube with the bottom belled out to 6-ft. diameter to fit into the cast-iron ring at the mouth of the discharge tube. While this cofferdam is in place the flow is diverted into the side hoppers.

The structure was designed by the writer, under the direction of C. R. Dart, bridge engineer, and G. M. Wisner, chief engineer, Sanitary District of Chicago.

Common Errors in Detailing Steelwork for Buildings

Weak Details of Three Main Types—Eccentric Connections of Beams to Girders or Columns Often Inadequate—Problems of Cantilever Beams—Strength of Curved Girders

By Edward Godfrey
Structural Engineer, Pittsburgh, Penn.

STANDARDIZATION in structural design tends to uniformity in both strength of details and workmanship. Uniformity in shopwork makes for economy, and no engineer can ignore economy. Uniformity in strength of details makes for safety, and no engineer can ignore safety. Safety should be the first concern of the engineer, but often it does not get the consideration that it should; so much attention is given the matter of designing economically that the safety of structures frequently receives secondary consideration.

The details and methods of design that are standardized are, of course, plain, straight work. There is no excuse for such to be other than safe. Departure from safe design and details is found generally in cases that appear to be but are not standard, and in cases that patently do not come within the range of the standards.

There are some errors of design that the writer has met with so frequently that in his mind he has classified them. The greater part of them occur in cases falling into three general classes: (1) Eccentric loads; (2) cantilever beams; (3) curve beams.

Eccentric Load Due to Column Bracket

In dealing with eccentric loading errors of design as well as of detail are frequent. A very common case of the former is found in the eccentric application of the load of beams or girders to columns. To be ultra-theoretical, of course, every case of beam connection to columns might be considered eccentric, but one of the things that the writer strives to avoid is fine-spun theory. He has given the matter of failures much study, and has yet to find a single failure where fine theory needs to be brought in to explain the cause.

In order to make clear what is and what is not practically central loading of columns, a few examples may be cited as illustrations. The ordinary case of a column with beams or girders connecting on all sides is,

of course a case of balanced loading, and need give no concern from the standpoint of eccentric loading, unless the load on one side is greatly in excess of that on the other side. When the latter is the case, there may be a bending stress worth considering. It is better and more economical, however, to make the details such that the bending moment is thrown into the girder instead of the column. It may sound odd or even improper to some minds to speak of shifting moments around in this manner by mere altering of details, but to the writer's mind this is one of the very important facts of structural detail designing. Engineers must learn to couple the theory of the toughness of steel with the theory of elasticity. A pertinent illustration will be given to show up this thing, which the writer believes should have a big place in all structural-engineering instruction.

Given the case shown in Fig. 1 at (*a*). Here is a heavy girder seated on a bracket at one side of a building column. The load is eccentric, and as it is the greater part of the load on the column the unit stress might easily be doubled or tripled by reason of the eccentricity. It is easy to see how this could cause the column to bend or even to fail, for the girder cannot assist the column in taking the bending moment due to the eccentric application of the load. But take the same girder and the same column and make the detail as at (*b*) in Fig. 1, and the case is quite different. By a little alteration in detail what might have been a dangerous piece of construction has been rendered perfectly safe. Considered merely as a detail to support vertical loads, either connection gives ample security, but from other standpoints the two are not equivalent.

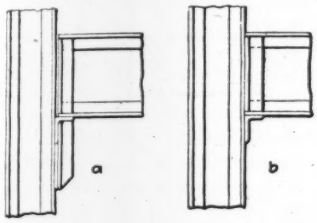


FIG. 1. ECCENTRIC LOAD ON COLUMN—GOOD AND BAD CONNECTION

This girder is, or should be, designed for a span equal to the distance between column centers. With the detail shown at (*b*) the portion of the column opposite the girder can be considered as virtually part of the girder. This makes the case equivalent to one of a centrally applied load with a girder ample to take all bending moments developed. It is impossible to conceive of a failure occurring here if girder and column are correctly proportioned for bending moment and central load, respectively.

Ultratheorists will say that by the theory of least work or the theory of relative rigidities the column should be designed for a portion of the bending moment. It is just this sort of theory and theorizing that confuses and disgusts the practical designer, and it is this that the writer believes has no place whatever in structural designing.

While there are many ways in which eccentric loading on columns may occur, in most cases the structural condition can be made practically equivalent to central loading by proper details. For a heavy girder a good web connection such as that shown at (*b*) in Fig. 1 is effective. For a lighter girder or beam a top and bottom flange connection may be sufficient; that is, an angle taking two or four rivets in the top flange of the beam and the side of the column and a corresponding number of rivets in the shelf angle, the shelf or seat being designed to carry the vertical load.

Various Cases of Eccentric Column Connection

Fig. 2 illustrates a number of cases of column loading. At (*a*) and (*b*) are simple cases of loading on one side only of the column. While the former gives a more eccentric load than the latter, the column is stronger to resist bending in this direction than in the other. The top and bottom flange connection is generally sufficient to take care of the bending due to eccentric application of the load. The case shown at (*c*) is another one of unbalanced loading, while that at (*d*) is balanced, assuming the beam on the right side to have a load about equal to the two on the left side. The loading at (*e*) is pretty well balanced. Those loadings at (*f*) and (*g*) are unbalanced and need flange or web connection to overcome this condition, and in (*g*) if the beam connecting to the flange at the left is a heavy beam, it may need in addition to the simple web connection a gusset plate, to accommodate more rivets than the web could otherwise receive.

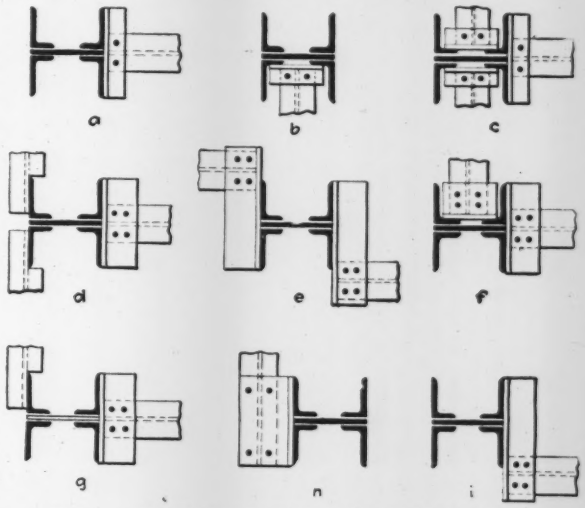


FIG. 2. NINE CASES OF ECCENTRIC LOADING

In the two cases of unbalanced loading shown at (*h*) and (*i*) the eccentricity cannot be counteracted by any detail of the connection to the column. This is because the plane of the beam does not intersect the column axis. It is cases of this sort that the writer finds give rise to weakness of design, for the eccentricity is frequently ignored, even when the succeeding floors all have the same condition. A little calculation will show that if the load is 12 in. or 15 in. off center in (*h*), or in the worse case (*i*), the unit stress is enormously increased. This cannot be ignored with impunity.

Where there is only one beam connecting to a column in this manner, the column should be turned so that the bending action is exerted in the strong direction, as at (*h*). In any event, the section should be proportioned so as to take care of the bending moment.

In general, when the load on a column is eccentric the bending moment can be divided, half of it being taken in the story above the applied load and half being taken in the story below. Thus, if a load P be applied d inches away from the column center, the moment to be added

to the direct load may be taken, without material error, at ½ *Pd*, except that when it occurs at the top of the upper story the full moment *Pd* must be provided for.

Details That Counteract Eccentricity

There are ways of counteracting the eccentricity of columns without incurring the necessity of increasing the section of the column for the full eccentric load. The writer has made use of the following means:

In the case shown in Fig. 3 the beam *C* would cause a heavy bending moment in the column, if connected on

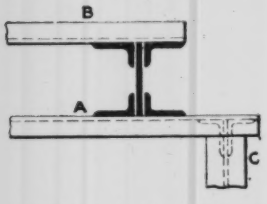


FIG. 3. A BEAM CONNECTION THAT AVOIDS ECCENTRICITY.

a bracket in the usual way. But the channel *A* can receive this beam and support it as a cantilever, the connection of the channel *A* to the column being made capable of carrying both the reaction of *C* and that of *A*. This load is then balanced, or nearly so, by the channel *B*, so that the column is relieved nearly all of the bending moment.

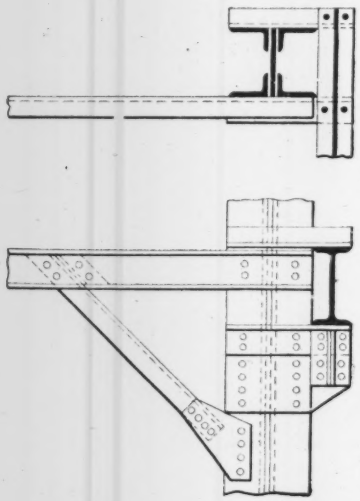


FIG. 4. SPECIAL COLUMN CONNECTION

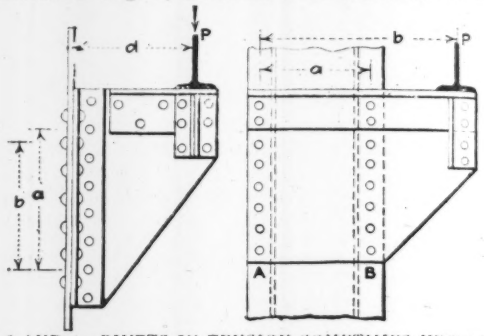
In Fig. 4 is given a case where the channel is not heavy enough to act as a cantilever for the beam. Here a kneebrace was added which served to stiffen the column and to relieve the bending moment in the channel.

Rivet Tension in Eccentric Connections

Eccentricity of rivet connections is also a source of frequent examples of weak design. Sometimes the detail is one that results in tension on rivet heads, and sometimes it means excessive shear on the extreme rivets of a group.

The writer is not among those who would avoid tension on rivet heads. He believes rather, that it is best to face the fact that there are occasions where tension on rivet heads is practically unavoidable, and to make the detail so that the tension is within reasonable limits. In other respects, also, the detail should be good. The thing against which the rivet heads pull must be capable of taking the pull, the angles must be heavy enough to stand the bending at the roots, the detail should be symmetrical, and there should be rivets provided for shear in addition to those for bending. The limit of tension recommended is one-half the single-shear value of the rivet.

There are many ways and many assumptions that may be employed to arrive at the strength of a connection where there is tension on the rivet heads. It is a case where approximate theory and approximate methods are just as good as the most exact theory. Given a bracket as in Fig. 5, assumed to be connected to some-



FIGS. 5 AND 6. RIVETS IN TENSION SOMETIMES NECESSARY; RIVET SHEAR IN ECCENTRIC CONNECTION

thing that is capable of taking the pull of the upper rivets and the inward force at the bottom of the bracket. The moment is *Pd*. The problem is to find the pull on the upper rivets. The compression at the bottom of the bracket does not need the same consideration. However, it is not proper to assume that this compression is taken at the extreme lower edge of the bracket, for this would imply a very heavy force on the edge which should be distributed on a flat surface. The writer would recommend that the bottom group of four rivets be used as the center of compression. Then a trial can be made of the top group of four rivets to take the tension, the lever arm being *a*. If this gives too great a stress per rivet, try the upper six, with the lever arm *b*. Apart from the rivets that are in tension, the connection should have enough rivets in sheer to take the vertical load. In this case there are eight, if six are required for the top tension of the bracket.

There are general and exact methods for determining the extreme stress on a group of rivets, where the load is eccentric and there is a twisting about the center of gravity of the group. These methods are to be recommended. A case frequently met with is that shown in Fig. 6. This can be solved by an approximate method: Given a load *P* on the beam seat and the distances *a* and *b*. By the principle of the law of the lever the vertical force on the row of rivets *B* is *Pb/a*. If there are enough rivets in this row, there will be more than enough in the row *A*, as the rivets in the latter row are forced upward.

Connections of Cantilever Beams

Errors under Class 2, cantilever beams, are generally errors of detail. Sometimes beams that must act as cantilevers are detailed with end connections that are standard for simple beams. Manifestly this fails to supply the requisite strength of connection.

An error very frequently made in connections where there are cantilever stresses is to provide for the top-flange tension and to ignore the bottom-flange compression. This applies to all brackets and is a common error in all classes of structural work. In bridge work

it is common to see sidewalk brackets detailed with provision for the top-flange tension and little or no thought given to the bottom-flange compression, a bent plate or such inadequate detail being provided for the latter.

A very short beam acting as a bracket may have but a small load to take as a cantilever, and if a standard connection is provided to take care of the shear it may suffice also for the moment. This will mean tension on the rivet heads, and some calculation should be made to see that this is not excessive.

In Fig. 7 at (*a*) and (*b*) are shown two details com-

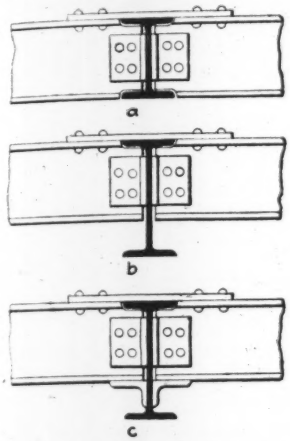


FIG. 7. CANTILEVER ATTACHMENT

monly met, where the top-flange tension of the cantilever beams is taken care of and the bottom-flange compression is ignored. In effect this reduces the depth of the beam one-half, for the compression of the bottom flange could be counted as taken by the standard connection at the middle of the beam. But the bending moment is very often too great to make this safe. The effective strength of the case shown at (*a*) Fig. 7 can be doubled by adding a bottom-flange plate similar to the one used in the top of the beam. That at (*b*) can be similarly strengthened by adding angles as shown at (*c*). If more than four rivets are needed, a longer seat angle and a gusset plate can be used.

Cantilever Brackets

Cantilever brackets are of frequent occurrence in building work, and these very often are detailed with little or no regard for the flange stresses to be taken. The top flange frequently has a one-sided connection and tension on eccentrically placed rivets. The bottom-flange stress is often inadequately provided for in using a bent plate or bent angles through which the stress must pass. It is not rare to find cantilever brackets where the top flange or the bottom flange fails to connect to anything that could resist their stress. Sometimes a heavy connection is made that would mean twisting on a girder with a force that the girder could not resist. Some times it is overturning on a small post or a bending moment on the post that it is incapable of taking.

It would be easy to cite examples of all these violations of the principles of stability that only need to be sketched out to demonstrate the errors, examples met in the writer's practice and in illustrated engineering articles. But for the present purpose it is sufficient to emphasize the fact that the ordinary standards for simple beam and column design do not apply in these special cases.

Support of Curved Beams

It ought not to be necessary to call attention to the obvious fact that when a beam is curved out of a straight line there are cantilever stresses at the end of the beam, and a simple end connection in the web of the beam or a seat for the end of the beam is not sufficient. But the writer has found that common practice justifies placing the most strenuous emphasis upon recognition of exactly this fact. There are theories about curved or circular girders that would scare most designers, and one would be justified in trying to sidestep these. But here, as in many other cases, simple methods of analysis can be employed with results that are satisfactory and safe.

Two things in particular need to be taken care of in a curved beam. One of these is the bracing of the flanges, both top and bottom, for the curve will tend to make the compression flange bend further and the tension flange straighten out. Lateral stiffness is therefore essential. The other thing that needs particular care in a curved beam is the flange stress at the ends of the beam due to the tendency to "flop down."

Curved beams are rare in a building, and some extra weight in the few employed does not cut much of a figure in the economy of the building. Hence a good stiff beam is the best solution of the problem of bracing the flanges. An oversized beam is in fact usually employed, and the flange bracing need give no particular concern when a good, heavy beam is used. Reinforced-concrete slabs afford a good means of stiffening the flanges of a curved beam.

In Fig. 8 a curved beam is shown which has a curve of 90°. It is recommended that points of inflection be

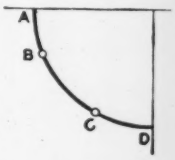


FIG. 8. A CURVED BEAM

assumed at the quarter points B and C and that the portion of the load of the beam between B and C be assumed as concentrated at B and C. Then for example, the cantilever moment at A can be found by taking moments around A, using the concentration at B and whatever other load may act on AB.

Sometimes, when the beam would have but a small curve, it is best not to put the curve in the steel work, but to use a straight beam and put the curve in the wood trim or concrete covering.

Decrease in Use of Horses in City Districts

While it seems probable that horses will continue to be used on farms without much, if any, decrease in number, their use in cities is decreasing very rapidly, according to the report of an investigation made by the field agents of the Bureau of Crop Estimates, United States Department of Agriculture. Horse censuses taken in recent years in New York City are as follows: 1910, 128,224; 1917, 108,036; 1919, 75,740. This shows a decrease of 41% in nine years.

Bridge Engineering in Active Warfare --- II

Civilian Bridge-Design Methods Applied in Work of A. E. F. — Bridge Department Organized — Unprecedented Loadings — Traffic Conditions — New Types of Bridge Developed — Reinforced Pontons—Sectional Steel Bridges—Flooring, Loads, Impact and Unit Stresses

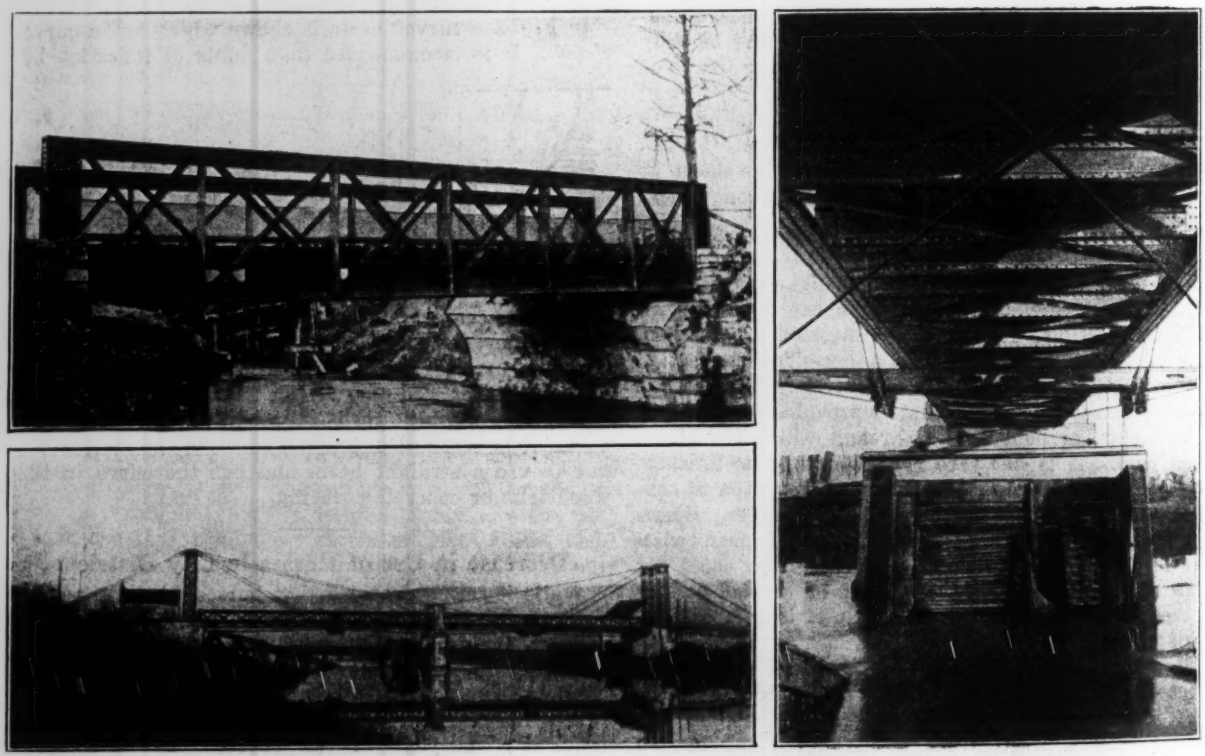
By Lewis E. Moore and Marshall W. McDonald
Formerly Major, Engineers, U. S. Army — Formerly Captain, Engineers, U. S. Army

The most important single development of the war in bridging was the construction and successful use of sectional steel bridges, which are structures capable of variation of length to suit different sites. The French were the only nation that had done anything in the matter before the war. The subsequent British and American developments were far superior, however, and constitute the best that has been achieved in this field.

Eiffel Type—A light portable bridge designed by Eiffel, the builder of the Eiffel tower, to carry light field-guns on spans of 30 m. or less, formed a part of the French pre-war equipment. It had to be discarded when the progress of the war made it necessary to transport heavier guns. The connections in this bridge were made by turned bolts or rivets, in reamed holes; the later French bridges follow the same practice.

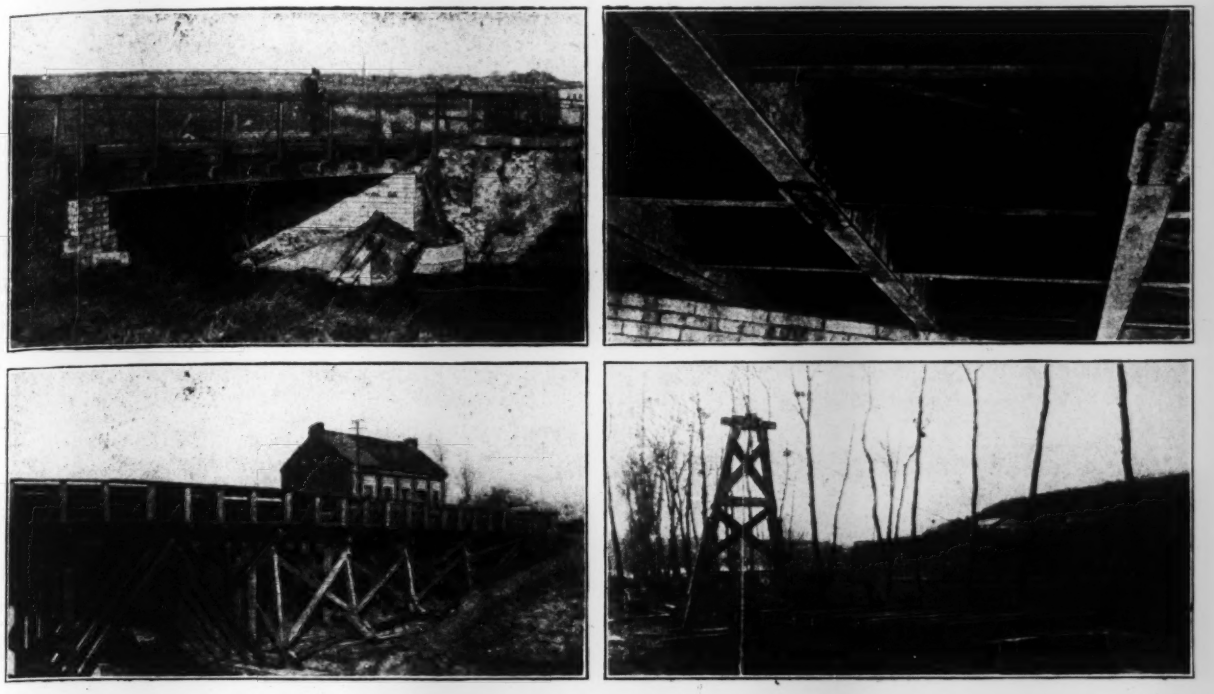
Pigeaud Type—Colonel Pigeaud, of the French Army, developed a different type of bridge during the war, adaptable to spans varying from 7½ to 30 m., in panels of 2.5 m. By reinforcement the same bridge has been used even up to 37½ m. (123 ft.). The trusses are low (pony). The load capacity of the bridge is about 17 tons on each of two axles 7.8 m. (26 ft.) apart. In this type the members are separate and are bolted together in place. Short spans are erected by launching, assisted by a gin-pole placed on the opposite bank to pull the bridge across; a nose or *avant bec* is sometimes used in launching. Longer spans are usually erected by the help of a temporary suspension bridge. By setting up temporary towers on the banks, slinging cables over these and suspending from them a floor made up of material from the floor of the permanent bridge, a working platform is obtained on which the trusses are assembled. The assembled bridge is lowered to its seat and then the suspension bridge is removed.

The Pigeaud bridge is very slow in erection. A much longer time is required than for other sectional bridges, and as a practical result it was noticed that timber bridges were used instead whenever possible. The slow erection is due to several factors: The fact that all members are separate, the use of tight-fitting turned bolts, and the use of the suspension principle. Its advantage lies in the fact that the heaviest pieces weigh only 660 lb. and consequently are easily handled. It has been widely used where long spans were required, as over a canal or in replacing demolished spans over a river, where the substructure was intact. However, all those seen tended to vibrate under traffic, and most of



FIGS. 21 TO 23. FRENCH PIGEAUD DEMOUNTABLE STEEL TRUSS BRIDGES

Above, Aisne Canal Bridge at Berry-au-Bac, fitted with wire netting guard. Below is exemplified the use of these trusses for longer spans by aid of the suspension system. This structure crosses the Marne at Bas Verneuil and has two openings of 40 meters clear, carrying highway and meter-gage railway with capacity 17½ metric tons on one axle; lateral bracing attached to outer ends of suspension chairs, as shown by view under float, at right



FIGS. 24 TO 27. STEEL I-BEAM BRIDGES

Above is shown standard spliced-beam bridge (British) over Souchez River near Lens; capacity tanks; note handrail and two-piece splice plate of main beams: Below, at left, is a trestle with steel stringers, made adaptable to the long span of the brook crossing by strutting (Escaut River near Denain). At the right is shown a 16-foot I-beam span which has just been launched by means of pulling across with hoist and tackle through an A-frame on far bank, with preventer tackle on near end (view taken at the United States Engineer School, Langres, France)

them had a pronounced sag. Several Pigeaud trusses also were used in building stiffened suspension bridges.

British Stock Spans—Like the American, the British sectional steel bridges were created during the war. Early in the war a series of "stock spans" was developed for openings of 16, 21½, 30, 60 and 85 ft. Successive increase in loads led to progressive development of stronger bridges, the same span lengths, however, being retained.

The three shorter spans are I-beams and the two longer spans are trusses. For the 16-ft. span the beams are full-length, while for the 21½- and 30-ft. bridges they are spliced so that the pieces come within more convenient transportation limits. Used with pile or framed-trestle supports these spans were very convenient for general bridging, in addition to having special application to single-span work.

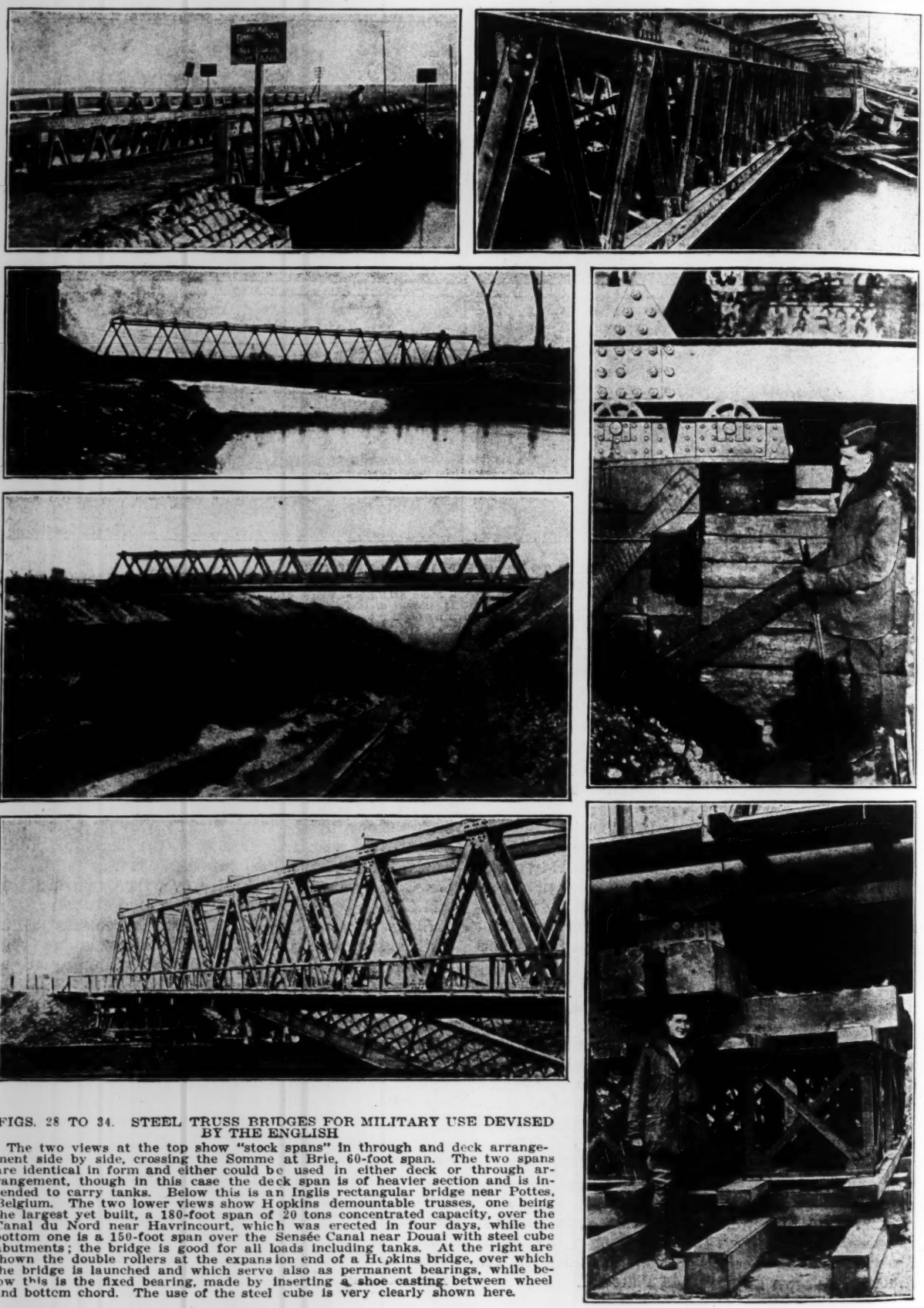
The 60- and 85-ft. spans are riveted and bolted pony-truss bridges, which may be used either as through or deck. They are unnecessarily clumsy in design, and some of the sections weigh 3.3 tons, which makes them difficult to handle in the field without special equipment.

Hopkins Trusses—To overcome this last objection, Captain Hopkins, of the British Army, devised a sectional truss bridge consisting of standard plates, angles and channels put together with bolts in the field. It was built in three sizes, known as the 75-ft. type, the 120-ft. type, and the "lorry bridge." These are excellent military bridges, especially the 120-ft. type, which will take single large tanks over a clear span of 150 ft. The view, Fig. 31, shows this type applied to a 180-ft. span and gives an excellent idea of its utility; its construction is shown in outline in Plate III.

Erecting the Hopkins bridge is done by launching, in all cases. Pairs of stationary wheels or rollers constitute the supports over which the bridge is rolled ahead, the front end of the structure being held up by a hoist rope from an A-frame on the far bank. The rollers remain as permanent supports, the double roller as the expansion end support, and a similar single roller seated under a concave bolster (see Fig. 34), fastened to the under side of the truss, as the fixed support. The bridge shown by the view, Fig. 31, was placed by this method; the span was erected on the bank and pulled across the gap with hand winches. It was built complete in four days. This bridge, over the Canal du Nord, will carry a concentrated load of 20 tons.

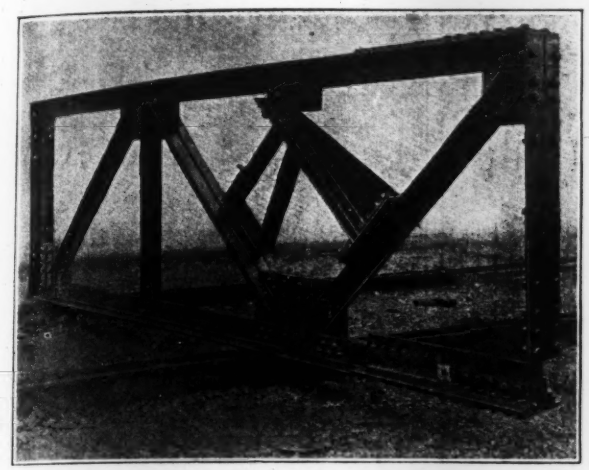
Inglis Rectangular—Modified Inglis construction is the basis of another type of British military bridge (Fig. 30). In this case the bridge has a rectangular cross-section, unlike the "Inglis Light"; but, as in the latter, the members are made of steel tubes joined by cast-steel junction boxes. The panels in this rectangular type are 12 ft. long, and the bridge is 12 ft. wide and 12 ft. high. It was designed for carrying a distributed load of 84 tons over a clear span of 84 ft. The bridge is erected by launching on a pair of wheels, like the other Inglis type.

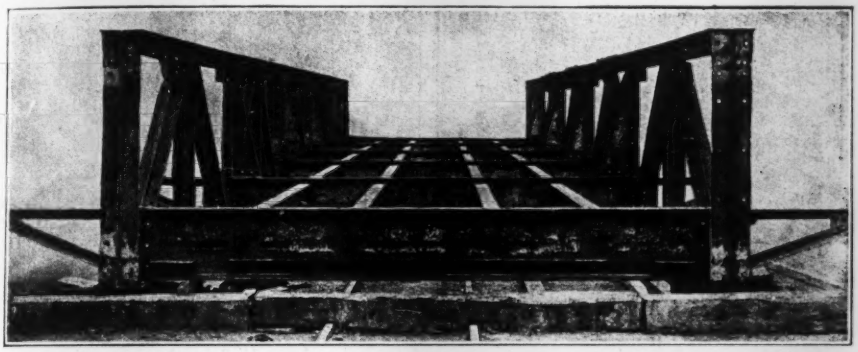
The Inglis rectangular was not used much, and it has the obvious objection that the members are special, expensive and not suited to regular shop methods or to quantity production. These bridges when used were replaced as soon as possible by "stock spans." It is said that a seven-bay span of the Inglis rectangular type could be erected and launched in five hours, which is fast working.



FIGS. 28 TO 34. STEEL TRUSS BRIDGES FOR MILITARY USE DEVISED BY THE ENGLISH

The two views at the top show "stock spans" in through and deck arrangement side by side, crossing the Somme at Brie, 60-foot span. The two spans are identical in form and either could be used in either deck or through arrangement, though in this case the deck span is of heavier section and is intended to carry tanks. Below this is an Inglis rectangular bridge near Pottes, Belgium. The two lower views show Hopkins demountable trusses, one being the largest yet built, a 180-foot span of 20 tons concentrated capacity, over the Canal du Nord near Havrincourt, which was erected in four days, while the bottom one is a 150-foot span over the Sensée Canal near Douai with steel cube abutments; the bridge is good for all loads including tanks. At the right are shown the double rollers at the expansion end of a Hopkins bridge, over which the bridge is launched and which serve also as permanent bearings, while below this is the fixed bearing, made by inserting a shoe casting between wheel and bottom chord. The use of the steel cube is very clearly shown here.





FIGS. 35 AND 36. AMERICAN SECTIONAL TRUSS BRIDGE—END SECTION SHOWN SEPARATELY

An intermediate section is of similar form with the omission of the far half panel. The separate floor-beam brace shown bolted to the truss for shipment has a projection extending outward to take the top of the sidewalk bracket shown just beyond; the sections weigh 2500 pounds each and will go into a truck body. The design represents the maximum of simplicity and interchangeability obtainable with regular structural make-up and detailing. The sections will make bridges of lengths from 33 feet 9 inches to 90 feet, good for the heaviest artillery loading and heavy tanks

Steel Bridges Developed by the American Expeditionary Forces

For the A. E. F., development of a successful sectional steel bridge was an early and important problem; and its importance steadily increased as the war went on. The development requird months; designs were completed in February, 1918, but although orders with complete detailed plans were sent to Washington in April they did not reach the fabricators until October, and the first bridges were turned out of the shop in the United States late in that month, too late for use in active warfare. The results of the work, however, show a convenient, efficient and widely applicable equipment.

Two types of standard steel bridge were worked out, I-beam and lattice girder, the latter being all sectional. The standard I-beam bridges are of three lengths: Nineteen ft., 24 ft. 9 in. and 33 ft. over all. Each stringer consists of a pair of I-beams riveted together with diaphragm spacers. The 33-ft. span is spliced, for ready handling. Two stringers with nailing strips and planking constitute a bridge (construction shown in Plate II).

Essential details of the sectional lattice truss span are given in Plate III. A complete structure of 56 ft. 3 in.-span and one section packed for shipment are illustrated by the views, Figs. 35 and 36. There are two kinds of truss section, end and intermediate, the intermediate section being one panel long while the end section is 1½ panels long. The floor-beams are 20-in. I-beams with shelf angles carrying the four 12-in. I-beam stringers. These latter are kept in place laterally by clip angles bolted to the floor-beams but not to the stringers. The stringers may also be placed on top of the floor-beams, for which purpose special clips are provided. The bridge may be built in deck arrangement, the floor-beams being then set on top of the trusses at the intersection of the diagonals with the top chord. Top flange braces are provided and also sidewalk brackets.

The panel length for this bridge is 11 ft. 3 in. and the depth of truss is 5 ft. 11 in. overall, which admits of placing the section in a truck body. Each section weighs about 2500 lb. The sections adjust to different span lengths, from 33 ft. 9 in. to 90 ft., by increments of 11 ft. 3 in. All bolts are 1-in. diameter, rough, and all holes are $1\frac{1}{16}$ in., reamed to iron templets, so that all like parts are completely interchangeable.

The bridge is for one-way traffic. Where a two-way bridge is required three trusses in all may be used, bolting both floor-beams to the center truss with the same bolts. In this case, tank and heavy artillery loads can pass over one roadway if the other is kept clear of traffic; as such loads are infrequent this restriction will not lead to undue delay to traffic.

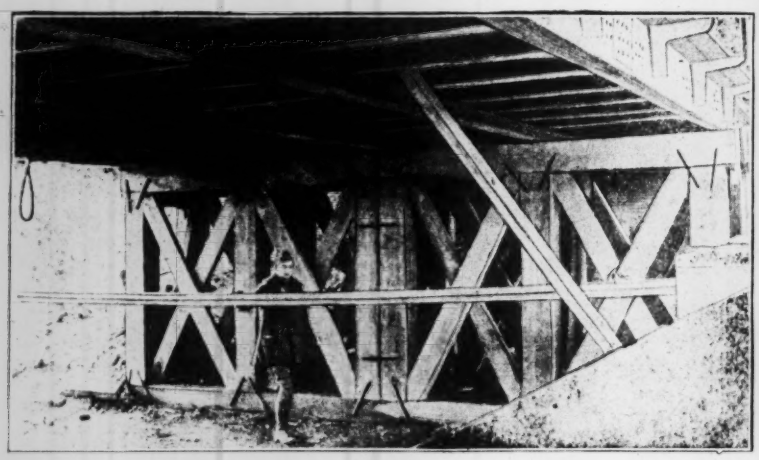
Suspension Bridges

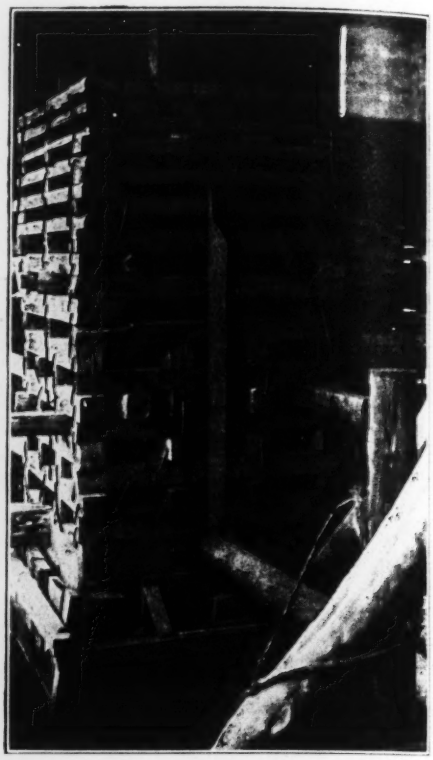
Suspension bridges are adapted for use as footbridges in occasional instances, on account of their ease in erection; with this exception they are not adaptable to modern military conditions, judging by the experiences of the campaign in France. The French repeatedly used the suspension principle to support the ends of adjoining trusses of their standard Pigeaud sectional bridges where the depth of water, poor foundation or other consideration made it more desirable than building a pier. In such construction (see views, Figs. 22 and 23) the ends of the trusses rested on a chair suspended from the main cables; lateral cable stays were provided to prevent swaying. The towers were built of steel cubes bolted together until the required height was reached.

Auxiliary Features of Bridges

Abutments and Piers—All kinds of abutments and piers were in service in the bridging in France, from simple mudsills to concrete and masonry structures. Abutments for ponton and timber bridges often were timber stringers laid (transversely) on mudsills. Piers were in one case formed of wagons set in the stream. Canal boats, anchored, made excellent piers in a few instances.

The Steel Cube—A very interesting and prospectively valuable development of the war is the "steel cube" used by the British for piers, and the American modification of this device.





FIGS. 37 AND 38. TWO ILLUSTRATIONS OF THE USE OF DOGS
Wooden pier for 30-foot I-beam bridge over Scarpe near Arras—Crib carrying I-beam bridge at Courtrai

The British construction is a 3-ft. cubical framework of steel corner angles connected by angle and bar bracing. The cube is 3 ft. on a side. It is shipped knocked down. Successive courses of these cubes are separated by wood planking to which the cubes are bolted. Care must be taken to set them level and to apply loads centrally, in order to avoid overloading, distortion or tipping. Examples of the use of the members are shown in Fig. 34.

American Sectional Pier—The American development of the cube idea is represented by sketches in Plate II. A steel angle framework of rectangular proportions is so arranged as to take plank sheeting set into its interior. With the sheeting in place such a frame can be filled with rock or other available material. The filling is intended to carry the load, and the sheeting and framework simply serve as container for the fill. Each unit has a steel angle lip on its bottom which drops into the top of the unit below to prevent lateral displacement. Various forms of assemblage are possible; some of them are sketched. Unfortunately, none of these pier units was used on account of the early termination of the war.

Flooring—Summarizing the experience gained from bridge traffic during this war, it may be stated that flooring should have a thickness of not less than 5 in. (single or double); the wearing surface (entire thickness in case of single floor) should be of hardwood, preferably oak or beech. On steel bridges the flooring should be spiked or lagscrewed to nailing strips on top of the stringers; no other method of fastening is adequate. Double flooring must have the upper course laid diagonally and thoroughly nailed to the lower course.

Tanks and tractors had the worst effect on the flooring. When the floor was not smooth or had large cracks, their cleats would sometimes tear out large pieces.

Handrails—Unless properly constructed, bridge railing will be sideswiped by trucks if the construction of bridge allows them to do so. The French therefore built their timber bridges with a narrow sidewalk on either side, or else put down a guard timber as a wheel curb. The British accomplished a similar object by giving the railing a flare of about 30°, not only to protect the railing but also to provide additional clearance for tanks.

Bridging Problems at Mine Craters

A specially troublesome problem often was the bridging at mine craters, an obstacle that an army in advance always has to reckon with. Where craters are encountered, it is to be considered certain that sooner or later they will have to be bridged.

An army in retreat not only blows up all the bridges, but also blows a number of road craters, which are very effective in retarding the enemy's advance. They not only produce delay and consume material, but, owing to the loosening of the soil by the action of the explosive, require a lot of maintenance before the road becomes normal again. Pile bridge crossings were built at nearly all craters with which the A. E. F. had to deal. Bridging is the inevitable recourse at craters, because in order to be really effective as obstructions they must be located where it will be difficult to detour traffic around them—as on an embankment across marshy ground, or at a side-hill cut, or a deep through cut, or in a village with no side streets. Crossroads were often blown up, a crater there blocking both roads. Many craters were

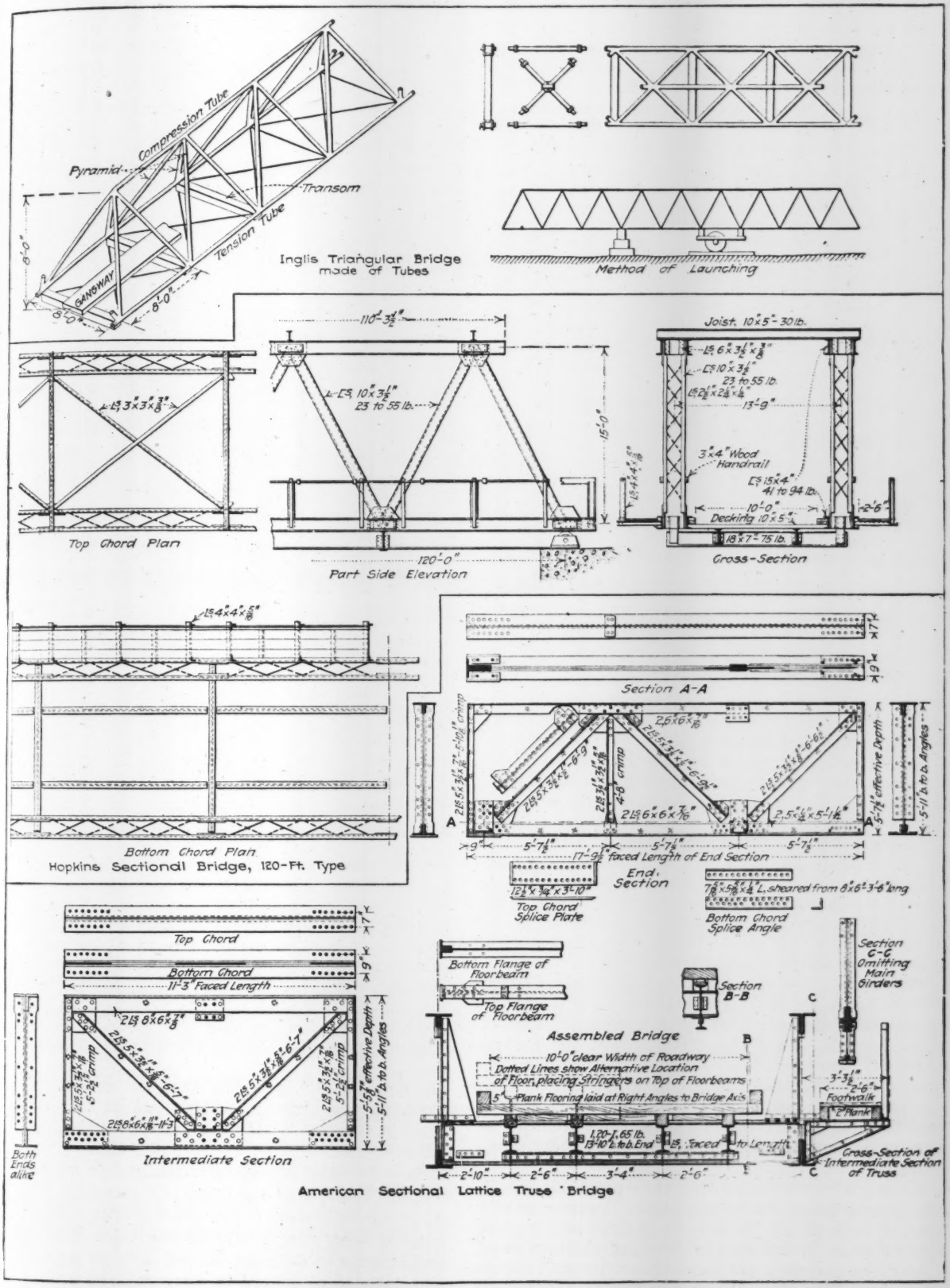


PLATE III—SECTIONAL STEEL BRIDGES FOR MILITARY USE—INGLIS TUBULAR BRIDGE; HOPKINS TRUSS BRIDGE; AMERICAN SECTIONAL LATTICE GIRDER

100 ft. in diameter and 20 to 30 ft. deep; and sometimes repair was rendered more difficult by the crater's filling with water. The view, Fig. 3, shows a typical crater.

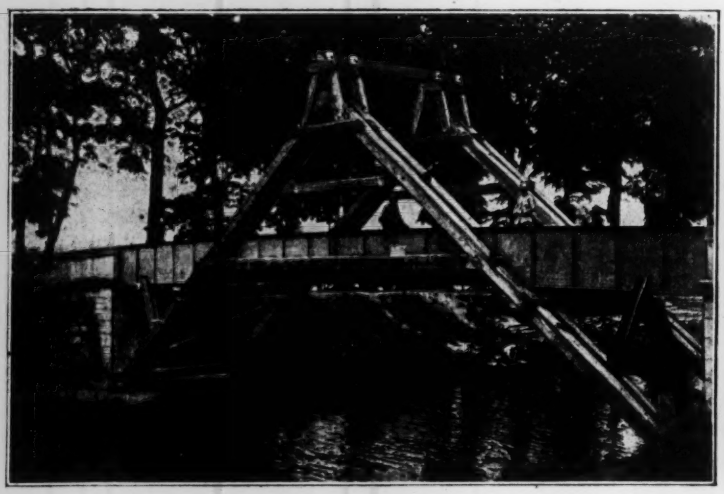
Effect of Shell Fire on Bridges—It was a very common occurrence for bridges to be damaged by shell fire, but cases where the bridge was sufficiently injured to require strengthening were rare. Generally such damage or complete demolition was incidental to the shelling of a road or some other objective, as it proved to be very difficult to destroy a bridge directly by shell fire. At Boureuilles one span of the masonry arch bridge over the Aire River was demolished by shell fire, but this was entirely incidental to the shelling of the German position in Boureuilles. Shell damage to bridges is apt to be only local. At Consenvoye a cast-iron I-beam bridge was struck by a large-caliber shell; the result was that four of the I-beams, in one span only, were broken.

American bridge engineers will find it instructive to take note of the fact that in France most bridges are built from the start with chambers in piers and abutments for blowing them up in case the approach of the enemy in war makes their demolition necessary. In these chambers are posted signs stating the exact amount of explosive required for demolition.

The importance of this subject is made obvious by the remarkable extent of the demolition work in certain operations of the war. During the spring campaign of 1918 along the Somme the British destroyed bridges estimated at many millions of dollars. It is certain that, in several of the large movements of the war, bridges numbered by thousands were destroyed. Such work is vital to cover a retreat, and provision for it in peace-time bridge construction is therefore especially interesting.

Where no means of the kind were provided, demolition often entailed considerable labor. In the case of a masonry arch bridge the common practice was to place heavy charges in holes cut in piers and abutments and lighter charges on a platform under the arch crown (see view, Fig. 41). Where the bridge had several spans, sometimes only the central span was blown up and the piers and abutments were blown toward the center, so as to block the stream and flood the country above. Extra large charges in the abutments, making large craters, increased the difficulty of reconstruction.

In the case of steel bridges, the French practice was to cut all the members in a certain panel or panels and thus drop the span. Melinite cartridges were fastened to the various members and connected by either melinite or electrical fuses. The method was very effective for making temporary gaps; and a number of bridges cut in this way were dropped without materially damaging the rest of the structure (Fig. 40). The Germans usually broke the truss up so that no portion could be used in rebuilding, and sometimes succeeded in throwing the whole span in such a way that a new bridge could not be built on the same spot without first clearing away the débris.



FIGS 39 AND 40. REINFORCEMENT AND REPAIR A FAC TOR IN MILITARY BRIDGING IN FRANCE
Special timber trussing to strengthen existing steel girder bridge for 20 tons (instead of six tons); Custine Canal near Belleville, span 20 meters—Marne Canal Bridge near Epernay, cut by French in 1914 by melinite cartridges and later restored by raising and supporting on a horse. Canal clearances were a controlling factor in both operations

Military Bridge Loadings

Increase in size of artillery, the use of heavy tractors to draw them, and finally the development of the "heavy" tank, weighing 67,200 lb., were responsible for the rapid increase of bridge loadings during the war. According to the final status of methods, the principal loads which must be provided for are as listed in the diagram compilation, Plate I. The moments produced by certain of these loads on spans up to 30 ft. are given by the curves below the diagram. From these it may be seen at once that the loads tend to divide into four groups.

It may be said generally that, as experience has shown, all the highway bridges (except footbridges) should be designed for the upper group; that is, for the 67,200-lb. tank on short spans or the string of 16-ton tractors on long spans. Practically the same substructure is required for heavy and for light loading, and in wooden bridges it is a simple matter to make the stringers heavy enough to carry the tanks. Steel spans should *always* be designed for the tanks, as it is highly undesirable to be obliged to carry on hand steel spans for diversified loading, or to risk breaking down the

bridge by running a tank over a span unable to carry it.

In connection with loads, the possibility of restricting loading and speed on certain bridges deserves a word. In war it is vitally necessary to foresee and provide for the actions of the fool; in bridges as much as elsewhere. The only way to keep excessive loads off a bridge, it has been found, is to post guards over it. In spite of warning signs, drivers would always be willing to risk the trial, unless guards forcibly prevented them. It is thus possible for even a momentary interruption in the guarding or an error of judgment to lead to the breaking down of a bridge, with the result that a road is interrupted which may be vital to military success. Speeds are in effect always unrestricted, as experience amply demonstrated. Motor trucks were run under nominal speed limits, but these were nominal only. That the loading of trucks was also nominal in some measure may be instanced by numerous cases of three-ton trucks loaded with about eight tons of ammunition. These considerations argue most strongly for making all bridges of heaviest capacity.

There are very few highway bridges in the United States, with the exception of masonry arches and some city bridges, which are capable of carrying modern military loads. In order to be available for possible future military operations, all parts of highway bridges (this affects chiefly floor members and hangers) should be of sufficient strength to carry one 30-ton (60,000-lb.) axle with 6 ft. wheel-gage, no allowance being made for impact.

Impact and Working Stresses

The subject of impact on highway bridges can be argued at great length. For wooden military bridges it seems good judgment to neglect impact entirely.

For steel bridges judgment and experience had to be relied upon almost wholly. It is interesting to observe that the British and Americans arrived at practically the same conclusions independently; namely, that the proper impact allowance for steel spans was 50% of the live load. The British used 50% for all members, while the Americans used it for steel stringer bridges and for the floors of latticed trusses; for the trusses themselves they used 40 per cent.

In designing wooden stringer spans for tanks, fiber stresses 60% higher than those recommended by the United States Forest Service may be used if the timbers are sound.

In steel bridges, with the 50-40% impact above mentioned, it seems justifiable to use 20,000-lb. fiber stress in tension and compression (reduced). Approximately these values were used in designing the American sectional steel latticed bridges. The values apply to ordinary structural steel. If high-strength steels are used the unit stresses could be suitably increased, thereby reducing the weight of the structures materially.

Bolts and Dogs

A noticeable feature of military practice as differentiated from civil is the exclusive use of bolts in field connections of steel structures

At the start of the war, turned bolts in reamed holes were used. They were troublesome because slight damage or rust made it very difficult to insert the bolts or afterward to turn the nuts It was also difficult to make the holes match exactly, because of the rough character of the supports. Turned bolts were therefore wholly abandoned by the British, who substituted rough bolts $\frac{1}{16}$ in. smaller than the hole. It was found that the resulting connections were fully as satisfactory as those made with turned bolts, and a great deal of time was saved in erection. At first $\frac{7}{8}$-in. bolts were used, but the desirability of reducing the number of parts

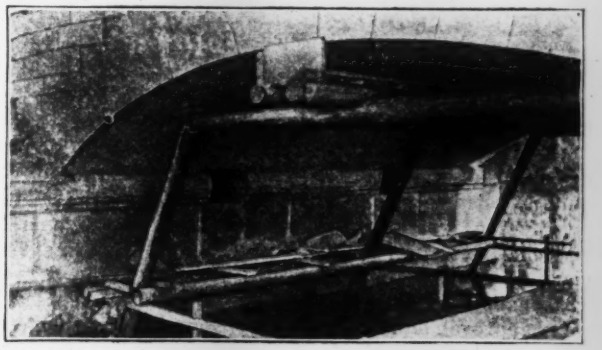


FIG. 41. BRIDGE PREPARED FOR DEMOLITION (HANONVILLE)

Note explosion chambers in piers and frame under crown to support explosives to be placed there

led to increasing their size, until some of the sectional bridges, notably the Hopkins, used bolts at least 1¼ in. in diameter for main connections. The American sectional bridges used rough bolts 1 in. in diameter.

No difficulty was experienced with bolts or nuts working loose.

European bridge practice (and for that matter other constructional practice in Europe) is noteworthy for the extensive use of dogs in place of driftbolts or scabs in the timber framing. Dogs—pieces of iron consisting of a bar, say, 18 in long, and pointed at both ends and with the ends then turned at right angles to the body—hold well in such work as trestle bents of round or square timbers, and crib piers can be fastened together with them in remarkably short time and with ease.

It is worth remarking that there is no complaint that dogs loosen, and at the same time they probably damage the timber less than do through-bolts or driftbolts. They are as applicable to civil as to military practice, and unquestionably many instances could be found in American construction where their use would effect a saving.

Future Types of Military Bridge

The types of military bridge to be used in future wars will unquestionably depend upon the natural conditions found in the country in which operations take place. There is no prospect of any reduction in the loads to be carried; on the other hand, there may be a distinct increase in loadings, not, however, enough to bring highway bridges up to railway bridge requirements.

Pile and trestle bridges similar to the standard American types will unquestionably continue to be used. Very large rivers will require pontons, though these must be of much greater capacity than any now existing.

I-beam spans will be needed for many locations, for spans up to about 30 ft., within which range they are the best that has been developed. For spans of 33 to 90 ft., the American sectional steel bridge is satisfactory. Above 90 ft. a new type of truss bridge will be needed, probably something similar to the Hopkins type

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Labor, Capital and the Public

AN AMERICAN LABOR POLICY—By Julius Henry Cohen, Author of "Law and Order in Industry," "The Law: Business or Profession?" "Commercial Arbitration and the Law." New York: The Macmillan Co. Cloth; 5 x 8 in.; pp. 110.

Written by a lawyer who has attained distinction in strike controversies and settlements, this short, readable book deserves thoughtful attention. It has as its thesis or conclusion that the American way of solving the difficulties between capital and labor should be (1) to permit the free organization of (a) employers and (b) employees in all industries; (2) that the two sides shall come to voluntary agreements with each other; (3) that these agreements shall be validated by law, after approval, and be enforced by Government agencies. In his final paragraph the author says: "Freedom [on both sides—Editor] to organize, freedom to deal collectively, security from arbitrary discharge, security against strikes, resulting from the free interchange of opinions, but, when made, the compact subject to the approval of the community and, after approval, enforceable by the community—these would seem to constitute the basic elements of a new *democratic law and order*. To accomplish it we shall need to revise our legal conceptions of freedom of contract."

Citizen's Guide to City Planning

TOWN IMPROVEMENT: A Review of the Principles by Which Physical Improvement in the Town or City May Be Accomplished, With Observations as to the Effect of Such Improvement Upon the Life of the Community—By Frederick Noble Evans, M. L. A., Assistant Professor of Landscape Gardening in the University of Illinois, Etc. New York and London: D. Appleton & Co. Cloth; 5 x 7 in.; pp. 261; illustrated.

Designed as a citizen's guide or introduction to city planning, this volume follows much the same lines as a number of earlier books. The book is largely a compilation, often from other compilations. Such a practice need not lessen the value of a book essentially educational in character, but is likely to pass on and increase errors and misleading statements. Portions of the section on water-supply are poor, and the two pages on sewerage and sewage disposal are poorer still. A little help from one of the instructors or a well-informed undergraduate in the engineering department of the university with which the author is connected would have enabled him to improve this part of his book with advantage to himself and his readers. Notwithstanding such faults, the book contains much information and opinion that if carried home to a large circle of readers would help improve living and working conditions in our towns and cities.

For Municipal Ownership

ONE HUNDRED REASONS WHY ONE HUNDRED CITIES HAVE CHANGED FROM PRIVATE TO MUNICIPAL OWNERSHIP OF THEIR PUBLIC UTILITIES: Kansas City, Mo.: Burns & McDonnell. Paper; 5 x 7 in.; pp. 16.

An interesting array of facts and opinions favorable to municipal ownership, drawn largely from the waterworks field. Perhaps 10% of the "reasons" are of doubtful pertinency, and some are duplications—the same "reason" illustrated by another city—but they may be accepted as legitimate propaganda for inclusion in such a pamphlet. Many of the "reasons" are open to argument, but are "reasons" if the premises are correct. Such are a number of citations of lowered rates or increased revenue after changes from private to public ownership, with no data to show but that the burden of supplying water was merely shifted to the taxpayers. Many of the "reasons" would be considered valid by all except uncompromising opponents of municipal ownership, but most of the judicially minded would wish to weigh them against opposing arguments.

PUBLICATIONS RECEIVED

Under a Postoffice Department ruling made applicable to *Engineering News-Record* in July, 1919, it is no longer possible to give the prices of new publications announced under this head or of books reviewed in the preceding columns. Readers will therefore have to obtain this information as best they can. Most of the public documents and of the pamphlet announced may be obtained free on application, or at least by paying postage. So far as possible, the name and address of the publisher of each book and pamphlet are given in each entry

THE NEW INTERNATIONAL YEAR BOOK: A Compendium of the World's Progress for the Year 1918--Editor, Frank Moore Colby. New York: Dodd, Mead & Co. Cloth; 7 x 10 in.; pp. 791; illustrated.
Following its usual lines of comprehensive treatment of the events of the year throughout the world in all branches of human activity, this volume includes, besides its general information, a large number of articles and paragraphs of direct interest to engineers.

PRINCIPLES OF REINFORCED CONCRETE CONSTRUCTION--By F.E.Turneaure, Dean of the College of Engineering, University of Wisconsin, and E. R. Maurer, Professor of Mechanics, University of Wisconsin. Third Edition, Revised and Enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 485: illustrated.

STEAM TURBINES: A Practical and Theoretical Treatise for Engineers and Students; Including a Discussion of the Gas Turbine-- By James Ambrose Moyer, S.B., A.M., M. Am. Soc. M.E., etc. Fourth Edition, Revised and Enlarged. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 495; illustrated.
Methods of governing the calculation of the strength of the disk type of blade wheels, and recent development in marine practice, are more fully discussed in this than in earlier editions, and many changes have been made in other chapters, the author states in his preface. The first edition was reviewed in Engineering News of Mar. 18, 1909, and the second was reviewed Sept. 14, 1914.

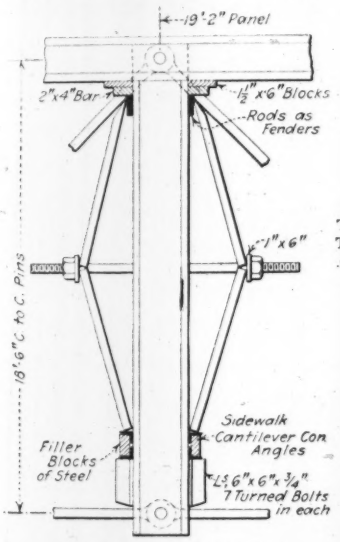
HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Toggle Relieves Load on Bridge Posts During Reinforcement Work

STRENGTHENING the 115-ft. approach spans to the 550-ft. steel arch bridge by which the Grand Trunk Ry. crosses the Niagara gorge at Niagara Falls, N. Y., required increasing the section of the truss posts, which would be overstressed by the E60 loading representing the new carrying capacity of the structure. To make the added metal effective, it was desired to rivet it in place while the posts were in unstressed condition. A very simple and effective toggle device made it possible to accomplish this result without placing the approach spans on falsework.

The approach spans, one at each end of the arch, are parallel-chord pin-connected trusses 18½-ft. deep, with Pratt web system. The posts are two-web riveted sections latticed in planes transverse to the bridge axis. The railway floor is on an upper deck, at the level of the top chord, while a highway deck is carried at the level of the bottom chord. Curved brackets stiffen the junction between the posts and the upperdeck floorbeams. Because of these brackets, any load on the upper deck subjects the truss posts to lateral bending, and in dealing with the question of strengthening the post both this bending and the direct stress due to truss action were taken into account. Charles E. Fowler, consulting engineer for the reinforcement work, concluded that the most effective way of strengthening the posts would be by riveting a vertical pair of angles to the outside face of each post web. But as these angles if riveted in place while the post still carried its dead-load stress would not be fully utilized, means were studied for taking the load off the posts during the work. At first it was thought that this would require shoring up the span, a matter of very great expense on account of the 100-ft. depth of the gorge slope. In this difficulty the prior use of a toggle for relieving the crown stress in the arch in order to permit measuring the dead-load stresses suggested that a toggle might be used in the case of the post also. The idea was carried out with entire success.


19'-2" Panel
2"x4" Bar
½" x 6" Blocks
Rods as Fenders
1" x 6"
18'-6" C. to C. Pins
Sidewalk Cantilever Con Angles
Filler Blocks of Steel
L's 6" x 6" x ¾" 7 Turned Bolts in each

TOGGLE AS APPLIED TO TRUSS POST, NIAGARA ARCH APPROACH

Each toggle, of which two were rigged up for the work on the posts, consists of four steel slabs 5 x 13 in., having a 2-in. central connecting screw with nuts on each end and large washer plates over the abutting ends of the toggle bars. At the outer ends the toggle bars are widened out to 16 in. by being forged down to a blunt chisel-shaped edge, but at the middle their meeting ends are left square and are butted without further preparation.

It was not possible to seat the toggle on the bridge pins, but by placing square steel blocks against the chords a satisfactory bearing was obtained without difficulty. Forcing the middle of the toggle together by the screw forces the two chords apart until the slack is taken out of the pin holes in the post. The point of no-stress condition is determined by taking readings with a strain-gage, and noting when the reduction of stress from the time of beginning operation of the toggle is equal to the computed dead-load stress. Then the reinforcing angles are applied, rivet holes drilled through angles and post webs, and the angles bolted up and at once riveted.

The toggle, when applied to a particular post, occasionally remains under load for as much as two or three days, while both decks of the bridge are in service. Though it thus has to carry all live-load stresses, no trouble of any kind has developed in the operation. The Terry & Tench Co., Inc., New York City, is doing the reinforcement work under the direction of Mr. Fowler, acting with H. G. Dickinson, superintendent, for the Niagara Railway Arch Bridge, owners of the structure.

Removing Marks Due to Belt Finishing From Concrete Roads

A METHOD of removing diamond-shaped serrations from belt-finished concrete roads was described in *Engineering News-Record* of Aug. 14, 1919, p. 338. In that instance the marks were removed by drawing the belt longitudinally over the surface a second time, with the forward edge slightly raised.

This method requires extra carrying of the belt, and care in keeping the front edge elevated as it is dragged forward. Albert R. Seiler, highway commissioner and village engineer of Gowanda, N. Y., has successfully used an ordinary garden hose instead of the belt. The hose is stretched across the road and dragged forward. Mr. Seiler states that all markings are satisfactorily removed by this method.

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

(Published Nov. 27, with Current News)

NEWS OF THE WEEK

New York, October 16, 1919

This Week's News

This issue carries news current for the week ending Nov. 19. It is dated Oct. 16 in order to preserve the sequence of numbers in the volume.

—X—

DETERMINED EFFORT TO NOMINATE GENERAL LANGFITT FOR CHIEF OF ENGINEERS

(Washington Correspondence)

A very determined effort is being made to induce the Secretary of War to depart from precedent and recommend to the President the name of Col. (until recently Major-General) William C. Langfitt for nomination as Chief of Engineers, as advocated by "Engineering News-Record" in an editorial in its Emergency Bulletin, Nov. 6. General Langfitt lacks several places of being the ranking officer of the engineer corps, but his service as Chief Engineer, American Expeditionary Forces was so notable that many are urging his appointment. It is understood that General John J. Pershing is among General Langfitt's supporters.

Col. Frederick V. Abbot is the ranking officer in the Engineer Corps and is acting as chief of engineers. His service during the war was confined to this country. There will be strong opposition in the Senate to his confirmation. It is understood that the Alabama senators are ready to take any legitmate steps within their power to block his confirmation.

Ranking next to Colonel Abbot is Col. Curtis McD. Townsend; but if appointed Chief of Engineers he would have but a short time to serve before he would reach the retirement age. In addition it is considered undesirable at this time to remove him from the head of Mississippi River Commission.

Strong endorsements are being received by the Secretary of War for Col. Lansing H. Beach. These endorsements are coming largely from the lower Mississippi River. Another candidate receiving serious consideration, it is understood, is Col. (formerly Major General) Henry Jervey, who is General Langfitt's junior and who served in the United States during the war as assistant chief of staff in charge of the Division of Operations of the War Department General Staff.

As a result of the recent Cape Cod Canal hearing it is understood that Col. Edward H. Burr's chances for consideration have been improved. His showing in a searching cross-examination is said to have made a favorable impression on the Secretary of War.

MACKSEY NOMINATED TO HEAD NEW ENGLAND WATER WORKS

Henry V. Macksey, superintendent of public works, Woburn, Mass., is the candidate for the next presidency of the New England Water Works Association recommended by the nominating committee in a report issued Oct. 23. For secretary Frank J. Gifford, superintendent of the Dedham (Mass.) Water Company, has been named as candidate; Willard Kent the present secretary served in that post for a continuous period of 20 years.

POSTPONE GOVERNMENT CEMENT FINENESS REQUIREMENT

In order to afford ample opportunity for mill adjustments the departmental cement committee has postponed the proposed increase in the fineness requirements for Portland Cement until Jan. 1, 1921. At that time the government will not allow over 20 per cent residue on the No. 200 sieve instead of the 22 per cent of the present standard specification.

AMERICAN ROAD BUILDERS HOLD ANNUAL MEETING

Resolution Restricting Federal Aid Funds to Through Routes Elicits Sharpest Discussion-- G.P. Coleman Elected President.

An ammendment to a committee report endorsing the use of other than concrete foundations for highways that must sustain heavy truck traffic, and a spirited discussion of a resolution proposing that Federal aid funds be used only for the construction of trunk line roads and bridges of adequate width and strength, were outstanding features at the annual meeting of the American Road Builders Association held at the Automobile Club of America, New York City, Nov. 7. The program included reports of seven committees, submission of resolutions, report of the Board of Directors and the election of officers.

H. Eltinge Breed, consulting engineer, New York City, declared in a progress report of his committee on widening narrow trunk roads that concrete bases be used in such widening for all types of roadway subjected to heavy truck traffic. Such a recommendation was objected to on the ground that the wide variance of soil and climatic conditions in different parts of this country and Canada, precluded the selection of any single type of foundation. It was claimed that in regions where frost penetration is excessive, broken stone foundations had proved superior to those of concrete. Argument against the recommendation of a single type was made also on the ground that it might discourage foundation experiments now being carried on. Mr. Breed's report was divided into discussions of road width, drainage and type of pavement. Paved surfaces, he said should be 20 ft. for two-line traffic with an additional 9 ft. for each added line of traffic and with shoulders ranging in width from 6 to 9 ft.

Use of Federal Aid Funds

The resolution proposing that Federal aid funds be used only in the construction of trunk-line highways and bridges of adequate width and strength was transmitted through the Board of Directors and read by the President A. H. Blanchard. Its reading, and a prepared discussion by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York City, brought forth lively protest from various members. Mr. Lewis' discussion, read by George C. Diehl, included recommendations that Federal-aid funds be used only for highways connecting main routes of highway travel within states, or on through routes; that a minimum road width of 24 ft. be adopted; that roads and bridges be designed to carry the heaviest highway traffic; that adequate study be made of drainage; and that characteristic signs be posted indicating a national highway. After half an hour's discussion separate motions were passed to lay the resolution on the table, and to consider the subject at the annual convention in February, before which time a committee will meet with the chief of the Bureau of Public Roads to get the facts regarding Federal aid work and arrange for an adequate discussion of the subject. It was argued against the resolution that the purpose of the Federal-Aid law was not to build a national highway system but to help the states in building the roads most important for the welfare of the individual states themselves; that it would be inadvisable to try to secure amendment of the present law, and that it would be distinctly unwise and unappropriate to pass such a resolution without giving the Bureau of Public Roads an opportunity to present its views. Arguments in favor of the resolution were that it was the common sense view that money be expended on roads of national importance or on through routes. Opinions were also expressed that Federal-Aid funds should not be applied to the construction of surfacings of a lower grade than waterbound macadam.

The annual meeting opened with a report of the committee on "Uniform Highway Signs" intended to supplement and close the report made to the annual convention early this year. It added to the original document a recommendation regarding a new curve sign, consisting of a curved arrow, with appropriate lettering. The recommendation was adopted.

(Continued on Page 746)

ESCH RAIL BILL PASSED BY HOUSE

Bitter Fight Over Strike Provisions-- Both Parties Fight Federal Control

The Esch railroad bill was passed by the House of Representatives, Nov.17, by a vote of 203 to 159,after the provisions applying to the settlement of labor disputes had been denounced as inadequate to meet the situation. Under the terms of the bill, present rate laws, as a whole, will stand; the powers of the Interstate Commerce Commission are broadened to cover decisions on securities issues and joint use of terminals, and rates are to be determined upon the basis of the public interest and a "fair return on the value of the property."

According to advices from Washington, consideration of the bill by the House displayed clearly that it had not been carefully studied by the membership prior to its consideration. Due to the need for prompt action, consideration of the bill began almost as soon as printed copies of the complicated measure became available. With two very important exceptions, the general plan proposed, as submitted by the committee, has been adopted.

An important change in the manner of refunding the carriers' indebtedness to the United States was made in an amendment proposed by Representative Denison, accepted by Mr. Esch, and carried by a vote of 134 to 69,providing that the refunding of the carriers indebtedness to the United States Government for capital expenditures be partially offset by deductions from rentals. Any remaining indebtedness of the carrier, to the Government in respect to additions and betterments, previously approved by the carrier, shall be funded by the Government at 6% interest chargeable to the carrier, with such security as may be prescribed by the President of the United States. Wide powers are given the President for making arrangements for the extension of time of payment or for exchange of securities acquired under this provision.

A bitter fight developed over the section of the bill dealing with disputes between carriers and their employees. It resulted in the adoption of an amendment proposed by Representative Anderson, with the approval of the railroad brotherhoods and followed the general plan for adjusting disputes which was in effect at the time the Government took over control of the railroads,but without any of the drastic provisions against strikes that appear in the Cummins bill now under consideration by the Senate.

Several comparatively minor amendments were adopted to safeguard the rights of states in matters pertaining to docks and railroads' jurisdiction for purely intrastate lines.

Opposition to government ownership by both the Democratic and Republican parties was indicated throughout the debate. The statement by Representative Esch that such ownership could never be a solution of the problem was received with applause from all sides, as were similar statements by others. Mr. Esch stated that this decision was reached by the committee after hearing proponents of the Plumb plan.

KANSAS TAKES OVER ALL COAL MINES IN STATE RECEIVERSHIP

Upon application of the attorney general of the state of Kansas, the state supreme court, on Nov. 17, placed all coal mines in the hands of three receivers, who will operate the mines to capacity and have full charge of produotion, sale and distribution. The receiverships are based on the inherent right of the state to protect its citizens. The Governor has made an appeal to the miners to produce coal for the state.

The receivers appointed are Clarence D. Sample, Mayor of Fort Scott, representing the public; Willard Titus, a coal miner of Girard, and C. F. Spencer of Pittsburg, President of the Pittsburg Midway Mining Company.

URGES EARLY TRANSPORT OF ROAD MATERIALS

In an address at the annual meeting of the American Road Builders Association, held Nov.7 at the Automobile Club, New York City, George P. Coleman, state highway commissioner of Virginia, the new president of the association, asserted that one of the four biggest considerations which demand action is the transportation of road materials. With such a vast amount of money available for road construction through Federal, state and county appropriations, Mr. Coleman stated, the railroads are not going to be able to meet the excessive demand for open-top cars when the construction season begins in 1920. He recommended the diversion of the 250,000 open-top cars that usually lie idle during the winter season to the use of contractors for the delivery of materials before the construction season opened.

Another feature of President Coleman's talk was the emphasis he laid upon the need for adequate training of highway engineers to supervise execution of our future extensive roadbuilding programs. These two problems and those concerning engineer compensation and the labor situation, Mr. Coleman asserted, were the four big considerations demanding action of the American Road Builders Association.

INTER-PROFESSIONAL CONFERENCE TO BE HELD AT DETROIT

With the purpose of bringing together the professional men of the country in order to plan more effective relations and act together on matters pertaining to the public good, an Inter-professional Conference is being called to meet in Detroit, Nov. 28 and 29. The subjects which might well come before such an inter-professional organization have been classified under three heads:

A- The functions and inter-relations of professional organizations.

B- Relations of professions to the public.

C- Educational obligations of the professions.

The Detroit program provides for an opening session in which representatives of the various professions will give their views as to the desirable objects,scope,method of procedure and organization for an inter-professional body.

The office of the organizing committee of the Inter-professional Conference is at 56 West 45th. St., New York. The meeting in Detroit will be held at the Hotel Statler.

REPORTS ON COMPENSATION ELICIT LITTLE DISCUSSION

Compensation of Engineers, announced as the subject for the Nov. 5th meeting in New York City of the American Society of Civil Engineers, drew an attendance of only about 350, in spite of the fact that 5000 notices of the session had been mailed from the office of the secretary. Arthur S. Tuttle, chairman of Engineering Council's committee on classification and compensation of engineers, opened the meeting by describing the work of the committee's state and municipal section and presenting facts and figures relating to living costs, union wage scales and compensation in other professions. Francis Lee Stuart and John S. Conway spoke respectively for the railroad and the Federal Government sections.

In their investigations the three sections of the committee have followed similar lines: The preparation of tentative classifications of engineers, a study of living costs, and comparison of other professional and technical compensations with that of engineers,based on the results of questionnaires. It was emphasized in the reports and subsequent discussion that no real progress can be made in increasing engineer compensation until a classification system and a minimum-maximum salary scale have been agreed upon. The committee's recommendations as to classification and scales are expected to be completed at an early date.

Those who had attended the meeting in the hope that the subject of compensation would elicit a lively discussion were doomed to disappointment. Except for a forceful address by William W. Brush, deputy chief engineer of the New York Department of Water Supply, who criticized the apparent apathy of members of the profession toward the all-important question of the hour, nothing of interest developed. Secretary Hunt cited figures showing that, on the basis of attendance in proportion to number of notices issued, engineers were apparently more interested in subjects of purely technical interest than those affecting their own pocketbooks.

GRAND TRUNK BILL PASSES

In spite of strong opposition the bill providing for the purchase of the Grand Trunk Ry. by the Canadian Government has passed the Senate and the House of Commons of Canada and only waits the formal consent of the Governor General to become law. It was adopted intact by the House of Commons, but amendments were made by the Senate providing that nothing in the act should be construed as limiting the liabilities of the Grand Trunk in respect to the Grand Trunk Pacific or its branch lines or other companies; also that the limit of the award to be made by the arbitrators, in the value of Grand Trunk stocks,be fixed at a sum that at 4% will not yield more than $5,000,000 annually, inclusive of the $2,500,000 already arranged for,as interest on the issue of $60,000,000 guaranteed stock of the company. These amendments were accepted by the House of Commons and the bill was finally adopted by a vote of 57 to 28.

AMERICAN ROAD BUILDERS'S ANNUAL MEETING

(Concluded from Page 744)

In presenting the report of the committee on "Economic Status of Guarantees for Pavements on Roads and Streets," Francis P. Smith, consulting engineer, New York City, read recommendations that, on new construction involving grading, foundation and wearing surface, the municipality retain from the contractor an amount equal to 5% of the aggregate of these items of cost. Another recommendation was to the effect that on an old foundation 8% of the cost of surfacing be retained. Retention of this amount from the contractor was deemed sufficient to cover ordinary defects in workmanship and insure the making within reasonable time of the necessary repairs, though totally insufficient to cover extensive repairs rendered necessary by serious defects or failure of the work. Protection against this latter contingency is assured by the guarantee bond. In the case of a two-year guarantee the committee made the recommendation that the whole of the retained fee be payable at its expiration and not before, and in the case of a five-year guarantee, one-fourth of the retained money would be payable two years after the completion of the pavement, and the balance in three equal installments. Another recommendation in this report was to the effect that if the contractor, having received notice from the engineer, fail to make and complete the ordered repairs within a reasonable time, the city has the right to undertake and complete the ordered repairs at the expense of the contractor or his sureties. Thirty days was named as the maximum time. The report which like the preceding one, was an amendment of the report of last February was received and adopted without amendment.

The report of the committee on "Civil Service Requirements for Highway Engineering Positions" was read by Henry G. Shirley, secretary-treasurer, Federal Highway Council, Washington, D.C. The chief items of interest in Mr. Shirley's report were the recommendation that all state highway departments be put under civil service and that the heads of departments be given the widest latitude in the appointment or dismissal of men serving within the departments. Recommendation was also made that the classification and salary schedule proposed for highway engineers by the American Association of Engineers be, upon its completion, included in the report. Mr. Shirley's report was received and adopted with two amendments: (1) That, instead of appointees always receiving the minimum salary, the amount of their salary, within fixed limits, be determined by the department head; and (2) that no residence limitation be placed upon those seeking appointment.

Officers elected for the ensuing year were: President, George P. Coleman, state Highway commissioner, Richmond, Va.; vice-president, Northeastern District, J. A. Duchastel, city engineer, Outremont, Canada; vice-president, Southern District, Prof. R. D. Kneale, Atlanta, Ga.; vice-president, Central District, Prof. Robert C. Terrell, University of Oklahoma; vice-president, Western District, S. Benson, chairman, Oregon State Highway Commission; secretary, E. L. Powers, editor, "Good Roads," New York City; treasurer, James H. MacDonald, former state highway commissioner of Connecticut. Directors elected to serve three years were: Northeastern District: Frederick E. Everett, state highway commissioner, Concord, N.H.; Thomas J. Wasser, county engineer, Jersey City, N. J.; and M. F. Bramley, president, Cleveland Trinidad Paving Co., Cleveland, Ohio Southern District: Charles M. Upham, chief engineer state highway department, Dover, Del. Central District: J. Frank Smith, general manager, Kansas Good Roads Association, Kansas City Mo.; H. K. Bishop, state highway engineer, Indianapolis, Ind. Western District: Samuel Hill, Seattle, Wash.

HOUSE PASSES RESOLUTION TO HURRY DISTRIBUTION OF ARMY TRUCKS

After protracted debate a resolution intended to hurry the distribution of motor equipment for road building purposes was passed by the House of Representatives. The resolution, which has no force of law, but simply is an expression of the feeling of the House, provides "that the Secretary of War be and is hereby requested to deliver immediately to the Secretary of Agriculture for distribution among the highway departments of the several states for use on roads constructed in whole or in part by Federal Aid, the 22,195 motor vehicles for which requisition has been made heretofore by the Secretary of Agriculture, and that all other Army motor vehicles now or hereafter declared surplus be offered for sale immediately at public auction to the American people."

Before its passage, the resolution was amended so as to include equipment and spare parts "which can properly be used with said motor vehicles".

The announced object of the resolution was to spur the War Department to more rapid delivery of motor vehicles to the Bureau of Public Roads. The War Department claims to be delivering vehicles as rapidly as is possible to the Bureau for distribution for the state highway department. The debate brought out the review of the whole controversy regarding the delivery of motor propelled vehicles for road service. Various efforts were made to amend the resolution so as to make it apply to other road building equipment, but in each case such amendments were ruled out as not germane.

An attempt was made to add to the bill a proviso "that in the states where the highway department has no jurisdiction over the road highway within the exterior lines of cities and other municipalities of such states the highway department shall, so far as practicable, assign and get over to such cities or other municipalities an equitable proportion of the motor vehicles delivered to such highway department under the authority given hereunder."

During the debate, an insistent demand was voiced for the passage of the Senate bill #3037, which now is on the House calendar, and which provides not only for the delivery of motor vehicles, but a long list of other materials which can be used for road building purposes.

WISCONSIN'S SUPPLY OF ROAD BUILDING MATERIALS NOT DEPLETED

Following the publication in the Emergency Bulletin of Engineering News-Record, Oct. 23, of a statement on shortage of road materials by Thomas H. McDonald, chief of the Bureau of Public Roads, the following communication has been sent to Mr. McDonald by the Wisconsin Mineral Aggregate Association:

"In Wisconsin, at least, we do not agree with this opinion. It is extremely easy for those legitimate producers of these materials to quickly increase their production where the demand warrants it. This situation is being watched closely by all of the present producers, with an analysis being taken of the prospective requirements for 1920, at least, and production plans are being arranged accordingly.

"In some localities or some states, there is no doubt but what a shortage of these materials will prevail, but it should be remembered that 'Engineering News-Record' covers an extremely large field and is just as likely as not to go into other localities aside from Wisconsin, where no particular shortage exists.

"We believe that where such articles of opinion are published that proper reservations should be made covering those localities not affected."

DISTRIBUTION OF ESTIMATED ROAD FUNDS FOR 1920

Along with a statement that the amount of money expended on road construction during the 1920 season will be dependent chiefly on the quantity of materials the present limited railway facilities can transport, the U.S. Bureau of Public Roads has given out the following data on the distribution of computed available road funds for 1920:

Brought forward from unfinished work on 1919 contracts, $165,000,000; funds available from state and county taxes and Federal aid, $273,000,000; one-fifth state and county bond issues not before available, $50,000,000; one-third unexpended balance of state and county bond issues previously available, $45,000,000; available from new bond issues to be voted on in the fall of 1919 and spring of 1920, $100,000,000.

ENGINEERING COUNCIL COMMITTEE DRAFTS MODEL REGISTRATION LAW

Basing the reason for state registration laws on the protection of the public's life, health and property Engineering Council's committee named to draft a model law, if it found one was desirable, has produced a draft for discussion after a 5-day session ending Oct. 17. The proposed law is simple, short and has several features not included in existing license laws. It covers professional engineering, architecture and surveying. Some of its features are as follows:

There are no definitions of an engineer or an architect, but the qualifications required of applicants indicate the committee's views.

On a state board of seven members appointed for four years' service by the governor at least three must be engineers and three architects. Each board member must have had 10 years' practice and be a member of a recognized society of engineers or of architects. Members are to receive pay while attending meetings, but it is not expected that this will be considered in any sense as adequate compensation for professional service.

No examinations are provided for, but each applicant for registration may submit under oath evidence of having satisfactory qualifications to practice. He may

tempo rily practice in the state on an unexpired certificate previously held in another state or in a province of Canada.

He must be 25 years of age, of good character, a citizen of the United States or Canada, or must have declared himself for citizenship, must speak and write English; must have had six years' active practice immediately prior to application, one year of which must have been in responsible charge of work. Teaching and study of engineering is considered active practice. A total practice of ten years or graduation from a four-year engineering course and four years' active practice qualify a candidate for registration, and likewise full membership in a recognized engineering or architectural society will be considered sufficient evidence of the candidate's eligibility unless other known facts disqualify him. A majority of the architect members of the board must pass on architects and a majority of the engineer members on engineers.

Revocation of registration is to follow conviction because of fraud, deceit, negligence, incompentence or misconduct. Penalties include fines of from $100 to $500 and three months in prison.

Definite provision is made for engineers to practice architecture and for architects to practice engineering, because it is not possible to draw a fine distinction between the two professions.

Exemptions include the following points: Simply offering to practice in another state; practicing not more than 15 days per year in another state if legally qualified in home state; practicing of new arrivals after application has been filed; practicing as an employee of a registered engineer or architect; practicing of United States officials on government business; employees of the state at time of enactment; individuals, firm or corporation on property owned by them unless it involves the public health or safety. This last point is intended to exempt maintenance work.

One year after the law goes into effect all state county and city engineers engaged in the supervision of public work valued at more than $2,000 must be registered.

T. L. Condron, consulting engineer, Chicago, is the chairman of the committee. The other members are J. W. Alvord, Rion J. Arnold, F. C. Shenehon, Farley Gannett, Prof. J.H.Dunlap, Prof. Arthur M. Green, Jr. Caleb M. Saville, James H. Herron, J.W.Woermann, A.L. Fellows, Amos Slater, A.M.Schoen, John Klorer and Christopher H. Snyder. C.F. Loweth, member of Engineering Council, sat with the committe.

The draft of the proposed model law for the registration of engineers is still subject to revision by the committe, and has not yet been submitted to Engineering Council nor has Council taken any stand upon the necessity for the registration of engineers or the desirability of such a procedure. This advance publication of the principal features of the model law in preparation by the committee is authorized solely for the purpose of gaining the benefit of discussion by engineers throughout the country so that Council may have such guidance when the question is taken up for action. The next meeting of Engineering Council will occur December 18. Comments on the proposed bill for the registration of engineers should be sent to Chairman Condron, Monadnock Block, Chicago.

WATER WORKS ASSOCIATION HOLDS FOUR-DAY MEETING

New England Convention Has Two Sessions on Hudson River Boat-- Well Arranged Program of Business and Pleasure-- Much Discussion of Drifting Sand Filters.

(Publication Delayed by Printers' Strike)

A varied program of both papers and entertainment marked the thirty-eighth annual convention of the New England Water Works Association at Albany, Sept.30 to Oct. 3. By scheduling no more than two papers for any one session there was plenty of time for discussion. Two of the sessions were held on one of the Hudson River boats, with luncheon between, through the courtesy of the Water Works Manufacturers Association. The same organization combined with the Rensselaer Polytechnic Institute and the Troy Water Department to afford a visit to the Institute and over the drainage area of the Troy water-works. The Institute provided lunch and threw its large swimming pool open to inspection. Moving pictures illustrating the manufacture of steel pipe by the National Tube Co. were shown on the evening of Oct. 2.

The need for a full-time official at the Association's headquarters in Boston was urged by Samuel E. Killam in his presidential address. Mr. Killam also recommended the adoption of the budget system by the association and suggested that in each of the 37 states represented in the membership there be a committee to watch legislation and report to the Executive Committee anything needing its attention.

The Dexter Brackett memorial medal for the most meritorious paper read before the association during the past year was awarded to David A. Heffernan, superintendent of water-works, Milton, Mass., for his paper on "Practical Methods of Determining Leaks in Underground Pipes". Patrick Gear, Holyoke, Mass., remarked that the medal had now gone successively to an engineer, a registrar and a superintendent and spurred on the superintendents to continue to keep at least even in the contest.

Committee work continues to be affected by the war, the various progress reports showed. No final report was submitted, but President Killam gave promise of efforts to see that a number of committees get down to work soon. One new committee was created, to deal with methods of meeting the cost of water main extension and of controlling the laying out of new streets.

A number of lengthy papers, some replete with engineering details were given. One of the most notable of these was entitled "Hydraulic Fill Dams of the Miami Conservancy District", by H.S.R.McCurdy, division engineer. The author outlined the Dayton flood of 1913 that led to the formation of the district, told how the district was created, described the river channel improvement and flood storage reservoir project and took up the construction work on the five dams, and the great conduits through them that will pass the entire ordinary flow of the streams on which the flood storage reservoirs are located.

Colonel F.F.Longley, who went to France in August, 1917 and organized the water-supply service of the A. E. F. outlined the work done overseas.

Superintendents Had Their Day

The single session on Thursday was devoted entirely to whatever subjects the superintendents might bring up for discussion. After somewhat over an hour of lively enough talk on fire hydrants broken by motor vehicles and on touching up pipe coating damaged in transit the session adjourned. As to broken hydrants, a number of superintendents seemed to have had no great success in collecting damages from the owners of the motor vehicles that caused the breaks, but one or two had collected not only such damages but also money wasted by the breaks. Common practice is to repair broken hydrants by welding.

No paper on the program gave rise to more questions and discussion than the one on "The New Drifting Sand Filter System at Toronto", by Norman J. Howard, bacteriologist in charge. (For detailed description of these novel filters see "Engineering News", June 25, 1914, p. 1446, April 8, 1915, p. 680, Dec. 21, 1916, p. 566, and Engineering Record, April 10, 1915, p.465, and for a summary of the contract test results see "Engineering News-Record", Oct. 31, 1916, p. 817. Those who asked questions were loath to believe that mechanical filters without coagulating basins and working at so high a rate as the Toronto filters were designed for could produce the guaranteed results. Mr. Howard stood his ground through the fusillade of questions, except that he was unable to go into operating cost details because these had not been supplied to him by the responsible authorities.

Except for a few sentences on preliminary tests, the paper on the unaflow pumping engine by D.A.Decrow, went over the ground covered by the author at the Buffalo convention of the American Water Works Association ("Engineering News Record", June 19, 1919, p.1193) With only 10° superheat available (against 100° intended), some 200 lb. steam pressure, 95 lb. water pressure, 27.2 in. vacuum, and 203 r.p.m., the steam consumption per indicated horse power was about 12.4 lb. and the duty about 140,000 foot-pounds.

The flat-slab covered reservoir at Dayton, Ohio, (see "Engineering News-Record", May 22, 1919, p. 1016) was described in a paper by Leonard Metcalf and William T. Barnes. The successful campaign against underground water losses at Washington, D.C., was outlined by Paul Lanhan, engineer in charge of waste detection. The city has been divided into districts, which are surveyed from time to time by means of the pitometer aquasphone and house inspections.

In the matter of patching up damaged coatings the discussion showed stress laid on cleaning the surface. President Killam said that on the Metropolitan Water-Works this is done by using oak or chestnut scrapers, followed by wire brushes. then ordinary brushes to remove the dust. For pipe too small to admit men, the cleaning tools are secured to the middle of a pole, operated by a man at each end of the pipe length, while the coating for patching up is applied with a brush at the end of a pole.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, 29 W. 39th St., New York City; Dec.2-5, New York City.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Secretary, J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.; Dec.3-6, Savannah,

NATIONAL RIVERS AND HARBORS CONGRESS, 824 Colorado Building, Washington, D. C.; Dec. 9-11, Washington, D. C.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, Secretary, Joseph Hyde Pratt, Chapel Hill, N. C.; Dec.8-11, Louisville, Ky.

AMERICAN MATHEMATICAL SOCIETY, Secretary, F. N. Cole, 501 W. 116th St., New York City; Dec. 30-31, New York City.

BRIDGE BUILDERS' & STRUCTURAL SOCIETY, 50 Church St., New York City; Jan. 16, New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS, 29 W. 39th St., New York City; Jan. 21-22, New York City.

The New York Chapter of the American Association of Engineers plans to secure an attendance of 500 at the meeting in the Engineering Societies' Building, Nov.26, to which members are invited to bring ladies. Dr.F.H. Newell, president of the association, is included on the list of speakers.

The Maine Society of Civil Engineers held its annual field day meeting in Waterville, Me., Oct.28. Among the speakers after dinner were C. W. James, assistant chief engineer of the Bureau of Public Roads, and Prof. Burr and Dean H. S. Boardman of the University of Maine.

Cincinnati Chapter of the American Association of Engineers, meeting in Cincinnati, Nov. 7, formulated plans to increase its membership from 180 to 250 before the end of the year.

The American Society of Sanitary Engineers will hold its 1920 convention in St. Louis in September, according to recent information from that city.

The Engineering Society of Buffalo was addressed Nov.11 by Charles H. Norton, chief engineer, Norton Co., Worcester, Mass., who spoke on "American Federation of Industry."

The Engineers' Club of Trenton was addressed by H. E. Skougor on "Proposed Plan of the United Port of New York and New Jersey" at the meeting Nov. 13.

PERSONAL NOTES

W. G. TRIEST severed his connections with the Snare & Triest Co., general contractors, of New York City, on Oct. 31, and has formed the Associated Contractors, Inc., in which he will continue in the general contracting business, with offices in New York City. Mr. Triest's withdrawal from the Snare & Triest Co. comes after a period of 20 years' continuous service with that organization. He began his professional practice with the Passaic Steel Co., of Paterson, N. J., in 1888 and two years later became associated as principal assistant, with A. B. Boller in the preparation of plans and supervision of construction of the 155th Street viaduct and other important structures in New York. Entering private practice in 1897 as contracting engineer he executed many structural steel and building contracts, among them a $300,000 fireproof building job for the Brooklyn Navy Yard. He became vice-president of the Snare & Triest Co. in 1899 and as an executive of that organization handled many million dollars' worth of large-scale construction, including subway and elevated work in New York and dock and warehouse projects in Philadelphia and elsewhere. Mr. Triest enters upon his new work with a long and successful experience in the general contracting business.

JOHN ERICSON, for many years city engineer of Chicago, has resigned and has entered private practice, at the same time accepting an appointment as consulting engineer to the Chicago Department of Public Works.

MAJ. H. W. DURHAM, Engineers, U.S.A., returned from France in mid-October after a long term of service with the American Expeditionary Force. Major Durham was on Brigadier-General Jadwin's staff in charge of the road section of the Division of Construction & Forestry. Upon the signing of the armistice he was given complete charge of road repair work undertaken by the American engineers in France. In July, 1919, he was assigned to the Liquidation Commission to assist the Department of Agriculture in the accumulation of road repair machinery in France and the shipping of it back to the United States. Major Durham was formerly chief engineer, Bureau of Highways, Borough of Manhattan.

COL. CLARENCE S. COE, U. S. A., previously assistant to section engineer, base No. 1, St. Nazaire, France, recently sailed from New York to represent the head of the advisory mission to Serbia.

MORGAN CILLEY, previously of the editorial staff of "Engineering News-Record", has become vice president and assistant manager, Tharp & Co., transportation engineers and distributors of the United States motor truck for Pittsburgh and western Pennsylvania.

J. B. MARCELLUS has been appointed associate professor of civil engineering, University of Colorado, but will continue to spend some time in consulting work.

COL. A. H. ACHER, Engineers, has resigned from regular army to become chief engineer, United Food Products Corporation.

JAMES T. TAYLOR, Honolulu, T.H., has been appointed resident engineer and chief inspector of Belt R. R., Koolaupoko, Oahu, with headquarters at Kaneohe.

CARL H. REEVES, discharged from the service, has resumed private practice as a consulting engineer in the American Bank Bldg., Seattle, Wash.

LT. WM. L. STANTON, 304th Engineers, discharged from the service, has left the Whitehead & Kales Iron Works, to become an instructor in the College of Engineering, University of Michigan.

F. A IRVINE, has resigned as city engineer of Jamestown, N. Y., to enter private practice.

H. G. McGEE, captain, sanitary corps, U.S.A., Camp Dodge, and later hydraulic and sanitary engineer, Des Moines, Ia., has become connected with the Bureau of Municipal Research, Akron, O.

OBITUARY

BRIG. GEN. WILLIAM T. ROSSELL, former Chief of Engineers, U. S. Army, died recently at New Brighton, N. Y., at the age of 70. He retired as chief of engineers in August, 1913, and afterwards engaged in private work. He was graduated from the United States Military Academy at West Point in 1873 and entered the Corps of Engineers as second lieutenant, later becoming assistant professor of civil engineering at the U. S. Military College. In 1892 he was appointed engineer-commissioner for the District of Columbia.

WILLIAM DIXON WEAVER, previously editor of "Electrical World", "American Electrician", and "Electrical Engineer", died in Charlottesville, Va., Nov. 1. His engineering training began in 1876 with his entrance in the United States Naval Academy. After several years study at the Sorbonne, Paris, he accompanied the first Greely Relief Expedition in 1883. In 1893 he became editor of the original "Electrical World" and three years later enlisted the aid of James H. McGraw in the foundation of the "American Electrician", of which he became the first editor. Soon afterwards the "Electrical Engineer" consolidated, and Mr. Weaver and T. C. Martin became editors of the combined paper. He was active in the planning of the present Engineering Societies' Building in New York and in the success of the Electrical Engineering Library there.